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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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82 DOCUMENTATION AND INFORMATION SCIENCE 2348
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 2348
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2349
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2349
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 2352

89 ASTRONOMY 2353
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS N.A.
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2354
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2356
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2356
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 2357

Note: N.A. means that no abstracts were assigned to this category for this issue.

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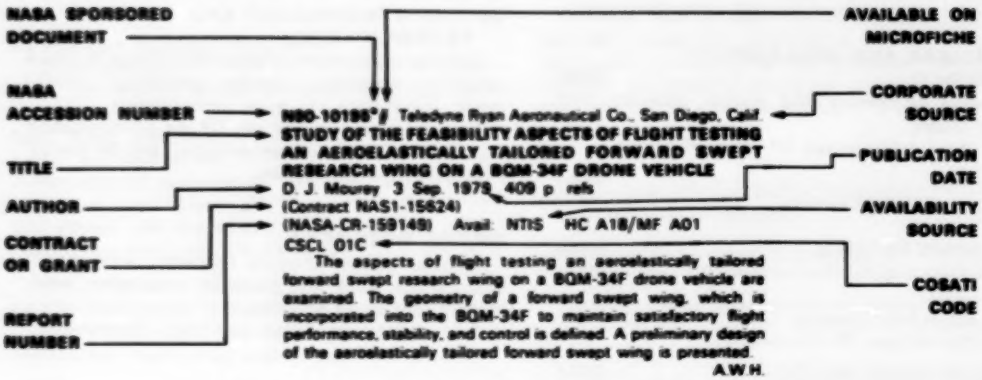
TYPICAL CITATION AND ABSTRACT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TITLE
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
PUBLICATION DATE
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The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, FUEL/ENGINE/AIRFRAME COST TRADE-OFF STUDIES

T. Peacock, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (DF461870; F33615-78-C-2001)

To determine the optimum aviation turbine fuel properties based upon an examination of the trade-off/relationship between fuel, engine and airframe.

Examine the fuel refinement/aircraft system trade-off so that an optimized solution to the alternate fuels problem may be formulated. In addition to refinery operation cost factors, estimates of combustion and fuel system modifications as well as airframe alterations will be made. exploratory development programs will be intensified in areas identified by the study as critical or sensitive.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0002, DEVELOPMENT OF SUPERSONIC STORE SEPARATION METHOD FOR NON-CIRCULAR AIRCRAFT

J.N. Nielsen, Nielsen Engineering & Research Inc., *510 Clyde Ave., Mountain View, California* 94043 (DF137080; F33615-76-C-3077)

This work unit supports TPO 3, flight control, and flight control system design techniques. Combat effectiveness of military aircraft has decreased over the years. The objective of this effort is to increase combat effectiveness of future systems by developing an analytical tool through which store separation may be factored into the total system design. Using the tool to be developed under this work effort, self inflicted damage can be reduced as well as increasing the safe release envelop of future systems. A method to mathematically model the flow field in the region near realistic supersonic aircraft will be developed and used to predict store separation trajectories.

The approach will develop an anlytical method in conjunction with an experimental program. The analytical effort will involve development of mathematical models for the flow fields around realistic fighter-bomber type aircraft. Next, an experimental program to gather flow field data will be conducted in Tunnel A at AEDC. Finally, this data will be used to refine and substantiate the methods developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, CARBON/CARBON COMPOSITE FOR ADVANCED TURBINE ENGINE EXHAUST

Unknown, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF464260; F33615-78-C-2078)

Characterize the properties of carbon/carbon composite materials applicable to the turbine engine exhaust nozzle.

(1) Material selection, (2) oxidation testing, (3) mechanical and physical testing, and (4) flap liner design.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0004, F101 CENTRAL INTEGRATED TEST SUBSYSTEM EVALUATION

Unknown, General Electric Co., *7735 Old Georgetown Rd., Bethesda, Maryland* 20014 (DF463660; F33615-79-C-2022)

To evaluate the effectiveness of a state-of-the-art turbine engine monitoring system.

4400 hours of engine flight data will be correlated with monitoring system output and maintenance actions. Results will be used to provide an indication of system effectiveness.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - HIGH ANGLE OF ATTACK STABILITY AND CONTROL

S. Gully, Analytic Sciences Corp., *6 Jacob Way, Reading, Massachusetts* 01867 (DN575168; N00014-75-C-0432)

At high angles of attack the flying qualities of most high performance aircraft deteriorate due to undesirable characteristics such as wing rock or departure from controlled flight. These characteristics significantly reduce tracking capability and maneuverability and can lead to loss of control and difficult or impossible recovery problems. The objective of this program is to develop an analytical framework of study for the high angle of attack stability and control problem, and to identify designs of departure preventing control systems.

Present efforts are being directed towards the validation of the pilot model developed during this project. The response patterns of the pilot model are being compared with these of human pilots.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0006, DEVELOPMENT AND DESIGN OF THE ADVANCE ACCESS PANEL FASTENING SYSTEM FOR HELICOPTERS

Unknown, Foster Miller Associates Inc., *135 2nd Ave., Waltham, Massachusetts* 02154 (DN081192; N62269-79-R-0222)

To develop an advance fastening system for helicopter access panels, that would not depend on the stud receptacle type panel fastener presently used. To exploit new contruction techniques and concepts and to develop a useful fastening system that will be highly reliable and overcome the inadequacies of the present system. This contract supports work unit ZA601, Agency Accession No. DN681080.

Define problem area, exploit and evaluate new construction techniques and concepts. Based on this evaluation, select optimum design and design concept.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0007, DEVELOPMENT OF IMPROVED FUEL QUANTITY MEASUREMENT SYSTEM FOR FUTURE NAVY AIRCRAFT
C. Buzzell, General Electric Co., *50 Fordham, Wilmington, Massachusetts* 01887 (DN081110; N62269-78-C-0433)

The general objective of this task is to develop Navy capability to define and specify aircraft fuel system components for advanced types of Navy aircraft in the 1980 era. Future high performance naval aircraft will require both airframe and engine sensors that are improvements over the current state of the art. Flight regimes for such aircraft will be particularly demanding in areas such as fuel management. The specific objective is to develop a fuel quantity measurement system with accuracy equal to or better than a Class III system and having improved reliability over present capabilities in probe systems.

Two approaches have been considered. One uses fiber-optic probes the other uses ultrasonic probes. The ultrasonic approach was started in Sep 79.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0008, FLUID & MECHANICAL POWER TECHNOLOGY DEMONSTRATION
K.E. Binns, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458380)

To demonstrate new technology for potential aircraft users. Specific technology to be demonstrated will be 30,000 rpm vane pump, oscilating spool power transfer units, electrohydraulic digital actuators and emergency back up fuel pump system for F-16 aircraft.

Prototype hardware delivered as result of AFAPL R&D contracts will be installed in laboratory systems and demonstrated to potential users. Tests of a 30,000 rpm vane pump will be conducted to verify its performance for use in future A/C hydraulic systems. In-house concepts will be pursued.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0009, TURBINE ENGINE INTEGRATION ANALYSIS PROCEDURES
E.G. Blevins, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF452670)

To generate the propulsion system (inlet, engine, exhaust) performance trends and establish the engineering techniques necessary for improving delivered thrust-fuel flow characteristics during engine part-power operation.

Generate time-phased analysis and test techniques that forecast elemental propulsion system performance to defined levels of accuracy. Identify critical tests that must occur to define exhaust system-engine performance interreffects. Identify engine and exhaust system internal changes that are necessary to maximize delivered thrust at low throttle ratios.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0010, GROUND EFFECT TAKEOFF AND LANDING SYSTEM (GETOL)/ALTERNATE AIRCRAFT TAKEOFF SYSTEM (AATS) DEVELOPMENT/TEST/EVALUATION
R.J. Almassy, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143840)

This effort supports the development of ground effect takeoff and landing (GETOL) systems and alternate aircraft takeoff system (AATS) for Air Force aircraft. Current aircraft equipped with conventional wheel type landing gear are limited to operating on fixed, costly runways, and are limited in their ability to be launched from bomb-damaged runways. The objective of this effort is to accomplish in-house analysis and laboratory testing needed to establish the feasibility and a sound technical base for GETOL and AATS development. A GETOL system will provide ability to operate at any level ground site and is not tied to the use of fixed airfields. Thereby, aircraft mobility is increased, while aircraft vulnerability and costs for airfields are significantly reduced. AATS will provide a rapid means to launch current fighter aircraft from bomb damaged runways to accomplish urgent missions.

Analytical techniques will be developed for the prediction of getol performance and operational characteristics. Laboratory and model flight testing will be conducted to obtain data needed for analytical technique development, criteria establishment and evaluation of GETOL and AATS concepts. An AATS advisor team will be established and used to review and evaluate ongoing AATS efforts, and to assist in the preparation of AATS advanced development program (ADP) plans.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, HIGH-ANGLE-OF-ATTACK SIMULATION STUDIES
M.E. Bise, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144250)

This work unit supports TPO 3, flight control, and major thrust FG02B, flight control system design techniques. Specifically, it addresses the problem area of aircraft performance and loss of control due to roll/pitch inertial coupling at low airspeeds and high roll rates. The technical objective is to analyze data gathered from 1) a manned simulation at the AFFTC, Edwards AFB, 2) a digital analysis and 3) two recently developed high-angle-of-attack (AOA) pilot rating scales. This data will be used to identify factors that limit high-AOA maneuverability, specifically, roll/pitch coupling. The information gathered will be used to improve the understanding of the high-AOA phenomenon and develop improved design guides for high-AOA maneuvering flights.

Analysis of high-AOA aerodynamic data, simulation time histories, the flight control system, and pilot comments (already gathered in previous work unit 24030512) will be conducted to identify factors that limit high-AOA maneuverability. Specifically, this will involve the identification of factors that cause roll/pitch coupling characteristics of a statically unstable aircraft at low airspeeds and high roll rates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0012, VISUAL ENVIRONMENT PROBLEM ASSESSMENT STUDY
E.D. Blanch, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142860)

The function of this effort is to support the development of design specifications and legibility criteria for advanced multipurpose displays. The problem has been that there is a need to document crew station illumination and display legibility problems in order to permit systematic solutions. The objective of this effort is to conduct a cross sectional survey on USAF pilot opinions on crew station illumination and display legibility problems with respect to the mission requirements of a wide variety of aircraft. A second objective is to obtain mission correlated visual environment data. The data obtained from this effort will aid in the identification of crew station illumination problems within a mission context and substantially enhance AF capability to develop meaningful design critieria for alleviating potential problems with display technologies for future aircraft. The successful completion of this effort will result in recommendations to support the development of design specifications for crew station lighting improvement, display legibility improvement, and low life-cycle costs.

To survey crew station illumination and display legibility problems, FGR will formulate a pilot questionnaire. This proposed research effort will involve an extensive literature review of existing studies relevant to the problems of cockpit illumination and display legibility of past and current aircraft. Problems which cause degradation in display legibility and mission performance on single and multi-purpose CRT and standard instruments will be identified and documented. Data will be collected on aircraft accidents related to crew station illumination and display legibility problems. Data will be obtained on mission related visual effects such as flares, weapon detonation and flashes. This effort will utilize the above information to update and de-

velop a questionnaire that assesses crew station illumination problems with respect to the mission requirement of current aircraft. This questionnaire will be administered to pilots current and proficient in the latest AF aircraft and the results will be tabulized and analyzed. A visual environment problem assessment technical report will be published and a computerized data base formulated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0013, DYNAMIC DERIVATIVE PREDICTION AND CORRELATION

R.J. Mattes, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143640)

This work unit supports TPO3, flight control, and major thrust FG02D3, aircraft stability and control prediction. Specifically, it addresses the problem of dynamic stability (damping) derivative prediction. The objective of this effort is to evaluate current methods for predicting damping derivatives and to develop and verify a method for predicting derivatives more accurately using experimental wing pressure data. The output of this effort will make it possible to more accurately predict the dynamic characteristics of an aircraft from wind tunnel data early in the design process.

Wing pressure data from the F-111/TACT program will be used in this program. These data will be used in a computer program that calculates the deformed wing contribution to the damping derivatives. The output will be compared with flight test and wind tunnel extracted derivatives. the program will be modified as appropriate to achieve accurate results and the final results will be documented.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dvnamics Lab.

1.0014, DUCT ACOUSTICS RESEARCH

D.W. Quinn, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143110)

To understand the dependence of sound levels within ducts upon such factors as duct geometry, sound absorbing properties of the duct walls, type of sound source, and flow within the duct. Specifically, to develop new aero-acoustic models and solution techniques for general duct acoustics problems. This work will be a significant contribution to the AF Aero Propulsion Laboratory's efforts to reduce turbine engine noise levels. To quote RN-AFAPL-08-72-9, 'Current engine noise levels are hazardous to personnel and structures, detrimental to tactical operations and annoying to the general public.' Eventually we should be able to 'Assess engine performance/noise trades' in the design of aircraft engines.

To handle variable area ducts with no flow a method of conformal mapping in conjunction with a finite difference method is used. As an alternative approach for the same problem an integral equation/potential theoretic method is appropriate. For the more general problem of variable area ducts containing fairly general flows a finite element method may be required. The acoustic equation for this general problem must be derived and an efficient numerical method must be implemented using local computer facilities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, DEVELOPMENT OF ACCEPTANCE PLANS FOR BITUMINOUS CONCRETE AIRPORT PAVEMENTS

J.L. Burati, Pennsylvania State University, University Park Campus, Pennsylvania Transportation Inst., *Research Bldg. B, University Park, Pennsylvania* 16802 (193038 (HRB NO.))

The objective is to develop a statistically based, price adjustment acceptance plan for bituminous airport pavement construction (FAA Item P-401). The procedure includes a review of literature to identify current practices, a data collection and analysis to determine quality levels on existing FAA pavement construction projects, and the development of price adjustment procedures.

SUPPORTED BY U.S. Dept. of Transportation, Federal Highway Admin.

1.0016, PROPULSIVE-LIFT POWERED RESEARCH MODEL TESTS

P.D. Whitten, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF142540; F33615-78-C-3032)

Recent wind tunnel tests and studies have indicated that significant STOL and maneuver performance benefits are possible as a result of propulsive aerodynamic concept application for advanced tactical aircraft. In particular, the combination of both spanwise blowing and upper surface blowing, e.g., the vectored engine-over-wing (VEO-wing) concept has been shown to provide improvements over the entire angle of attack range at subsonic and transonic speeds. Unpowered configuration model tests have indicated that viable design arrangements, which do not degrade performance, are possible, however, the powered data base is somewhat deficient. The objective of this effort is to expand the powered data base by experimentally investigating engine nacelle location, nozzle arrangements and control surface variations applicable to realistic advanced tactical aircraft configurations. Results will be available for assessment of the STOL and maneuver performance of air-to-surface and air-to-air fighters.

Testing will be conducted in the NASA/LARC 16-foot transonic and V/STOL wind tunnels using a contractor owned powered research model. Longitudinal aerodynamic/stability and control data will be obtained over the angle of attack range of minus 4 to 40 degrees and at Mach numbers from low speed to 1.2. Variations in nacelle location, nozzle arrangement and control surface deflections will be investigated at typical fighter aircraft engine operating conditions. The experimental data will be analyzed to verify the propulsion/aerodynamic benefits.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, FLIGHT CONTROL SYSTEM FOR ADVANCED MARITIME PATROL AIRCRAFT (MPA)

A.D. Stern, Boeing Co., Boeing Aerospace, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN081104; N62269-78-C-0234)

To develop the requirements and design of a minimum redundancy, fail-operational digital flight control system for the next generation patrol aircraft. This contract supports work unit ZA601, Agency Accession No 631080.

Design flight control alternate configurations and select the optimum system; develop mission requirements flight control interface; demonstrate software operation in laboratory.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0018, EVALUATION OF EXPLOSAFE

A. Szego, Canadian Commercial Corp., *Ottawa, Ontario, Canada* (DF460700; F33615-77-C-3115)

Evaluation of an advanced explosion suppression material called 'explosafe' for use in aircraft fuel tanks.

The program is structured into two major phases. Phase i consists of initial material qualification testing by the contractor and determining the feasibility of installing explosafe in aircraft fuel tanks. Phase II consists of the USAF evaluating the explosion suppression performance of explosafe at various densities and joint AF/Army evaluation against ballistic threats.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, SUPERPLASTIC FORMED ALUMINUM
H.C. Hamilton, Rockwell International Corp., *1049 Camino Dos Rios, Thousand Oaks, California* 91360 (DF143960; F33615-79-C-3218)

This work unit will support AFFDL TPO 1 structural mechanics technology goal FB04 'demonstration and validation of lower cost innovative structures and aeroelastic concepts'. This effort will investigate the superplasticity limitations of 7000 and 2000 series aluminum alloys and identify potential applications which can exploit the superplastic forming process to reduce aluminum assembly costs. The potential for these materials and processes to contribute significantly to an Air Force low-cost fighter thrust is substantial.

The approach to fulfill the above objective consists of a four task effort as follows: (1) assessment of the extent of cavitation or voids formed during processing, (2) formability limits, (3) fracture mechanics data on superplastic formed aluminum material, (4) application evaluation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

3.0002, ENERGY MIGRATION AND RELAXATION IN MOLECULAR SOLIDS
S.D. Colson, Yale University, School of Chemistry, Dept. of Chemistry, *206 Elm, New Haven, Connecticut* 06520 (CHE78-08123)

This research is in the area of Quantum Chemistry. Dr. Colson's program of study focuses on the processes of energy migration and relaxation that result from intermolecular interactions in molecular solids. The work is designed to capitalize on recent theoretical and experimental advances in the field and to accelerate the progress on both of these fronts. The understanding of the theory will be enhanced by providing critical new data and by working in close collaboration with other theorists in the field. The availability of this new data will result in part from the further development of new and highly sensitive laser spectroscopic techniques. In particular, he will study in detail the mechanism of long-range electronic energy migration in molecular solids. This information is of fundamental theoretical and practical importance. For instance, the efficiency of this process will impact directly on the feasibility of any molecular based solar conversion device. Of similar importance is the interaction between migrating energy packets (excitons) which can result in exciton annihilation and energy upconversion. He will measure directly the magnitude and distance dependence of these important exciton-exciton interactions. To complement these findings, a new absorption induced transient lensing technique will be used to study weakly absorbing states and to allow the non-radiative decay of molecular excited states. This research represents a continuation of that currently supported by Foundation grant CHE-7513771.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0003, DYNAMICS OF MULTIPHOTON ULTRAVIOLET PHOTODISSOCIATION
W.M. Jackson, Howard University, School of Liberal Arts, Dept. of Chemistry, *2400 6th St. N.W., Washington, District of Columbia* 20001 (CHE78-05375)

Dr. Jackson intends to continue and expand a program of research in the area of photochemistry. He will study the sequential multiphoton absorption by molecules of ultraviolet radiation produced by an argon fluoride laser. The absorption yields highly excited molecules which dissociate and yield small radicals which are electronically excited. Emission resulting from the decay of the radicals will be identified and measured. The effects of experimental parameters such as pressure, laser intensity, laser wavelength, and time will be investigated. Ground state products will be determined by laser induced fluorescence and with a quadrupole mass spectrometer. Such studies provide information about the properties of excited molecular fragments. Such information has potential importance with regard to future practical applications of lasers to chemistry.

This grant renews support of a research program currently supported under NSF Grant CHE-7512848.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, PROPERTIES OF COMPOSITIONALLY MODULATED ALLOYS
J.E. Hilliard, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science & Engineering, *633 Clark St., Evanston, Illinois* 60201 (DMR78-24339)

This is an investigation of the magnetic and superconducting properties of Cu-Ni, Ni-Pd, Pb-Sb, Nb-Ge and Pb-Bi foils containing short wavelength (8-80 AO) composition modulations produced by vapor deposition. These alloy systems will be investigated to determine if magnetic anomalies occur, and whether metastable crystal structures can be fabricated. These crystal structures can be fabricated. These crystal structures may have a high superconducting transition temperature. Another objective of this study is to determine the d-shell interactions and their correction to magnetic and superconducting properties. It is expected the results of this research will constitute an important addition to our fundamental knowledge in microstructural science.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0005, ADSORPTION ON METALS
R. Gomer, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (CHE77-08328 A01)

Measurements of absolute coverages, adsorbate dipole moments, and sticking coefficients of adsorbed gases on single-crystal planes will be extended to oxygen, CO, nitrogen, Xe and others on various planes of tungsten. Sticking coefficients will be measured as functions of coverage and surface and gas temperatures. Surface diffusion studies on single-crystal planes will be continued by measuring the time correlation function of field emission current fluctuations from regions of single planes when adsorbate-covered emitters are heated to temperatures where adsorbate becomes mobile. The two-dimensional equation of state of adsorbed layers will be studied by measuring the temperature variation of the mean square fluctuation. Field emission spectroscopic measurements will study the effect of metallic adsorbates on the surface resonance on tungsten and molybdenum planes. This resonance seems to survive to monolayer coverages for 'tungsten-like' adsorbates and one can obtain information about self-consistent potential at adsorbate atoms, using the resonance as a probe. Other electron impact desorption and low-temperature adsorption experiments are planned. This research is a continuation of that currently supported by Foundation Grant, CHE-7412059.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0006, SPECTROSCOPY IN SUPERSONIC MOLECULAR BEAMS
D.H. Levy, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (CHE7825555)

This grant will support the research of Dr. Levy in the area of structural studies of van der Waals molecules. Hence, the program is the responsibility of the Structural Chemistry and Thermodynamics Program. Dr. Levy will utilize supersonic molecular beam spectroscopy in order to simplify the spectral data.

The fluorescence excitation spectrum and dispersed fluorescence spectrum will be used to provide potential curves for NaAr. The potential curve for the state responsible for collisionally induced predissociation in iodine molecules will be extracted from van der Waals dissociation data. In addition, the dynamics of photodissociation of van der Waals complexes will be

examined. Complexes of rare gas atoms with chromyl chlorides as well as larger clusters of rare gas atoms with iodine will be systems of interest. An attempt will also be made to extend the work to nonvisible absorbing and non fluorescing molecules. Multiphoton ionization spectroscopy and coherent anti-Stokes Raman spectroscopy will be used to study nonfluorescent species.

This research is a continuation of that currently supported by Foundation Grant, CHE 7606098.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0007, PRECIPITATION PROCESSES IN REFRACTORY METAL-INTERSTITIAL SYSTEMS USING ANALYTICAL ELECTRON MICROSCOPY

H.L. Fraser, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mining Engineering & Metallurgy, *207 Engineering Hall, Urbana, Illinois* 61801 (DMR78-07761)

This is a study of phase transformations and precipitation processes that occur in refractory metal-interstitial systems, from the point of view of microchemistry and correlation of chemical changes with modifications in the morphology, microstructure, and crystal structure of the resultant precipitates. An important part of this program involves, of necessity, development of appropriate analytical electron microscopy techniques. The alloys chosen for this study include the Nb-O, Nb-N and Nb-O-N systems, since they exhibit multistage precipitation processes. Since the pure metal is seldom used in high temperature environments and energy conversion systems, Nb-Ti interstitial alloys will also be studied. The segregation of Ti will be determined, and the results obtained will be correlated to changes in the precipitation processes. In these studies, elemental analysis will be achieved through a combination of the complementary techniques of energy dispersive x-ray analysis and electron loss spectroscopy. Since application of the latter technique to light element analysis is relatively new, technique development is an important part of this research. It is expected the results of this research will contribute to an understanding of multistage precipitation processes in refractory metal-interstitial systems. This is the first year of a three year continuation grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0008, ENVIRONMENT-ASSISTED FAILURE OF FACE-CENTERED-CUBIC HIGH ALLOYS

N.F. Fiore, University of Notre Dame, School of Engineering, Dept. of Materials Science & Engineering, *Notre Dame, Indiana* 46556 (DMR78-07167)

This is a continuation of a fundamental investigation of the interaction between environment, metallurgical structure, and embrittlement in highly alloyed stainless steels (316 L and 20 Cb3) and Ni-base superalloys (alloy G and C-276). The alloys will range in structure from cold-worked to fine grained polycrystalline and single crystalline. Electrochemical hydrogen permeability measurements will define hydrogen mobility as a function of matrix composition and passive film behavior. Flow sorption studies will establish the extent to which aggressive ions absorb on the alloy surfaces, and to which inhibiting ions prevent adsorption and cracking. Electrochemical dissolution studies will establish the extent of selective ion dissolution present in the alloys. In all cases, environment-assisted-cracking (EAC) tendency will be established by time-to-failure and fracture mechanics testing. It is expected the results of this research will: (1) assess the validity of proposed EAC theories such as hydrogen embrittlement by decohesion, failure by stress-sorption, and selective-ion dissolution for these alloys; and (2) establish which metallurgical forms of these alloys show maximum resistance to EAC in standard H, Cl and S-bearing environments. This is a continuation of research previously funded under NSF Grant DMR76-08901 A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0009, HIGH-TEMPERATURE GAS REACTIONS USING THE COMPLEMENTARY SHOCK TUBE TECHNIQUE

R.D. Kern, Louisiana State University, University of New Orleans, School of Science, Dept. of Chemistry, *Lakeshore Dr., Lake Front, New Orleans, Louisiana* 70122 (CHE76-08529 A02)

The complementary shock tube technique continues to be a most powerful method to study the rates of reactions occurring exclusively in the gas phase at known temperatures, pressures, and densities. The strength of the method is the ability to record the dynamic behavior of reactants, products, and intermediates by utilizing two independent analytical techniques which when applied to the same reaction system provide a check on the sampling procedure and the validity of the experimental results.

The facility consists of two shock tubes. One tube is equipped to record simultaneously the infrared emission from two reacting species. The second tube is coupled to the ion source of a time-of-flight mass spectrometer. By this technique, in addition to the internal check on the kinetic data, systems which achieve an observable equilibrium condition are subject to external check with the calculated thermodynamic equilibrium constant.

The self-exchange of nitrogen is being examined to complete the trilogy (H2 plus D2 and 13CO plus C18O) of fundamental exchange reactions. The exchange of 15N16O plus 12C18O is being examined to assess the effect of an unpaired electron upon the exchange process. Studies of other exchange processes are being undertaken. Considerable effort is being devoted to complex reaction systems such as CNCl plus H2 and to CNCl plus HCN. The pyrolysis of water as generated from the reaction of CO2 plus H2 at elevated temperatures is also being examined. This work is a continuation of that currently supported by Foundation grant, GP-33949X.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0010, THERMODYNAMICS OF IONIC AND MOLECULAR CRYSTALLINE PHASES

E.F. Westrum, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Chemistry, *Ann Arbor, Michigan* 48104 (CHE77-10049 A01)

Dr. Westrum is studying the Verwey, Mott, and Wigner-crystallization transitions in magnetite (Fe3O4) and related phenomena in other spinels, molybdates and tungstates; the molecular freedom, plastic crystal and melting transition in nearly spherical carborane molecules, the magnetic and phase transitions in molybdenum compounds, etc. He is obtaining thermodynamic data for the molecular and ionic crystalline state, the mesomorphic phase and the transition to the liquid state. The energetic spectrum and thermal properties arising from structural anisotropy, are determined by precise, adiabatic calorimetry at least over the range 5-350 K and sometimes to 1500 K. Particular studies are being made on 'key compounds' and on the gradual transformation from classical solid-liquid behavior to mesomorphic phases. The thermophysical behavior of charge-transfer complexes in the crystalline phase, and the melting behavior of salts of organic acids are planned for intensive study.

This research is a continuation of that currently supported by Foundation Grant, CHE-7410317.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0011, THEORY OF HIGH-ENERGY ION-ATOM AND ATOM-ATOM COLLISIONS

J.S. Dahler, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Chemical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (CHE76-11037 A02)

This research involves the development and testing of efficient theoretical procedures for estimating the cross section (both differential and total) for a variety of the excitation and quenching processes that take place in high-energy (approximately 1-200 keV) ion-atom and atom-atom collisions. Among the many systems to be considered are alkaline earth ion-rare gas and alkali metal-rare gas pairs, e.g., Be ion, Mg ion.../He,.. Ne,.. and Li, Na.../He, Ne...Xe. The processes of interest include excitation and quenching of the projectile alkaline earth ions and alkali atoms, excitation of the target rare gas, charge exchange, and electron detachment. The plan involves the systematic investigation of a variety of scattering theory approximations including solution of the close coupled equations of the impact parameter method and Born and distorted wave Born approximations. Great emphasis is placed upon the testing and evaluation of different models for the electronic Hamiltonian operator or, more specifically, of the pseudo-potentials which are used (either explicitly or implicitly) to represent interactions of the electrons with the many-electron 'cores' of the projectile and target species.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0012, NOBLE GASES IN THE EARTH AND ITS ATMOSPHERE

O.K. Manuel, University of Missouri, Rolla Campus, School of Arts & Sciences, Dept. of Chemistry, *103 Parker Hall, Rolla, Missouri* 65401 (EAR78-09251)

This is a continuation of research supported under NSF grant EAR76-03956. This project concerns the measurement of the amount and isotopic composition of xenon, argon, and helium in terrestrial materials. The materials to be studied include CO2-rich fluid inclusions from a series of dunite xenoliths collected from recent lava flows in Hawaii, samples of josephinite and its serpentine host rock from the Klamath Mountains in Oregon, ultramafic xenoliths from the Matsoku kimberlite pipe in South Africa, and CO2-rich well gas from the U.S. Southwest and from Japan. Noble gases from these mantle-derived (?) samples appear to be isotopically very similar to noble gases from chondritic meteorites and may therefore be displaying characteristics inherited from the solar nebula condensate.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

3.0013, PHOTOIONIZATION AND PHOTOCONDUCTIVITY IN MOLECULAR MATERIALS

C.L. Braun, Dartmouth College, School of Arts & Sciences, Dept. of Chemistry, *P.O. Box 833, Hanover, New Hampshire* 03755 (DMR77-00318 A01)

The Principal Investigator continues his study of photoionization and photoconduction including work on liquid insulators as well as solids. A more detailed picture of photoionization, geminate charge recombination, and photoconductivity in condensed-phase materials is being developed. There are three principal goals: 1. To determine the primary quantum yield of photoionization for several molecules (e.g., benzene) as a function of excitation wavelength using high electric fields and fluorescence quenching as complementary probes. 2. To use Onsager theory to determine the distribution function of separation distances between just-thermalized electrons and their parent positive ions for a number of solutes, solvents and photon energies. 3. To understand the origins of photoconductivity near threshold energy. Spectroscopic observation of Wannier exciton series will be important in this effort.

This work should have practical significance for the understanding of quantum efficiency limitations of photoconductive devices and organic photovoltaic cells.

This is a continuation of research support under DMR72-03035.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0014, IMPROVED FROTH FLOTATION FOR MINERAL PROCESSING

R.K. Jain, Columbia University, School of Engineering & Applied Science, Dept. of Chemical Engineering, *Broadway & W. 116th St., New York, New York* 10027 (AER76-81578)

Froth flotation is acknowledged to be the most important process in use for the concentration of minerals in ores. The objective of this award is to gather complete information on froth flotation mechanisms necessary for the development of a new flotation process suitable for processing fine size minerals. This research is directed to quantify the effects of particle-bubble approach velocity, medium pH, hydrophobicity as measured by contact angle, interfacial potential as measured by electrokinetic methods, surfactant adsorption density, and contact angle hysteresis on the rupture kinetics of thin liquid film separating the bubble from the mineral surface. The quantitative data will be used to generate a mathematical model to serve as a tool in the design of flotation processes and equipment suitable for low grade ores.

SUPPORTED BY U.S. National Science Foundation, Div. of Advanced Energy & Resources Research & Technology

3.0015, OPTICAL PROPERTIES OF CERAMIC MATERIALS AT HIGH PRESSURE

K. Vedam, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DMR76-82074 A01)

This research will continue studies of the piezo-optical behavior of ceramics at high pressures. Specifically, the effect of high pressure on several optical properties will be studied, namely the refractive index, optical rotary dispersion, and circular dichroism. Research on determining the piezo- and elasto-optic coefficients of tellurium oxide, lead oxide-germanium oxide, and the nitrates of lead, barium and strontium will be completed. This is a renewal of NSF Grant DMR76-82074.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0016, CROSSED BEAM STUDIES OF EXCITED ATOM COLLISIONS

P.E. Siska, University of Pittsburgh, School of Arts & Sciences, Dept. of Chemistry, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (CHE76-84434 A02)

A continuation of the study of metastable rare-gas atom collisions in crossed molecular beams, currently supported by Foundation grant CHE-7403072, is planned. Time-of-flight experiments will allow the measurement of state-to-state absolute differential cross sections for electronic excitation transfer processes in a number of systems. Angle-energy distribution measurements for Penning ionization systems will continue, and they will be extended to include open-shell atom partners and halogen-containing molecules. Elastic scattering in nonquenching metastable atom systems is planned as a means of obtaining unambiguous information on excited-state potentials. Differential scattering measurements in H, N, and O atom systems also will be carried out.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0017, MOLECULAR BEAM REACTION OF ORIENTED MOLECULES

P.R. Brooks, Rice University, Graduate School, Dept. of Chemistry, *6100 Main St., Houston, Texas* 77001 (CHE77-09428 A01)

Dr. Brooks intends to continue and expand a program of research currently supported by Foundation grant CHE-7408466. He plans to study steric effects by studying the reactions of molecules which have been oriented in molecular beams. So far these studies have been limited to K atoms abstracting halogen atoms from simple alkyl halides, CH3I, CF3I, t-C4H9I, CCl3H, and CH3CCl3. The breadth of the studies will be extended by changing the alkali metal or the size and nature of the substituents of the CR3X molecule. A partially completed

apparatus with an unusual detector will ultimately enable him to extend the study of abstraction reactions to other atoms besides the alkali metals. The depth of the studies will be extended by velocity analysis of the product scattered from different orientations. These studies are necessary for complete understanding of any system, but it is also possible that reactive scattering from different ends of a molecule will proceed via quite different mechanisms and be reflected by different recoil velocity distributions. He also plans to study the reaction of a molecule which has been magnetically selected: the upper component of the NO doublet ground state can be separated from the ground state by magnetic deflection. He plans to study the reaction NO plus O3 yields NO2* plus O2 to see what effect the electronic state of the reagent has on the reactivity.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, ION IMPLANTATION IN SEMICONDUCTORS
J.W. Mayer, California Inst. of Technology, Graduate School, Dept. of Electrical Engineering, *1201 E. California Blvd., Pasadena, California* 91109 (INT78-08779)

The objective of this continued cooperative research project is to advance basic knowledge of the structures and properties of thin-film materials, which may lead to new and improved semiconducting devices such as integrated circuits.

The aim is to investigate the use of ion implantation systems for analyzing implanted semi-conducting materials, and for forming silicon-germanium heterojunctions. Rutherford backscattering techniques at low-energy levels (300-800 KeV) will be explored as an analytical tool; the regrowth of an amorphous layer produced by ion implantation with that of the epitaxial growth of an evaporated film will be studied to see if in this fashion heteroepitaxial growth can be induced.

This grant is for the continuation of a previously funded project investigating the implantation process in semiconductor (NSF Grant OIP-7401930 A01). The work will be conducted in cooperation with Dr. Jozsef Gyulai of the Central Institute for Physics, Budapest, Hungary.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

4.0002, NFMRAD MICROPROCESSOR FEASIBILITY STUDY (PHASE II)
R.A. Birgenheier, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DF902620; F19628-77-C-0073)

AF function - tactical battlefield surveillance mission. Deficiency or opportunity - Air Force lacks all-weather capability of tactical battlefield surveillance especially against concealed slowly moving tactical ground targets. Objective - the objective of this work is to continue the study of efficient microprocessor implementation for null filter mobile radar (NFMRAD) for standoff battlefield applications. How research contributes - research will define the efficient, minimal hardware implementations of an airborne null filter mobile radar.

A study will be conducted to investigate a means to incorporated a single knot moving target capability in the NFMRAD processing design. Also airframe presence and flexure as well as RF and PRF source instabilities will be considered for their affect on NFMRAD antenna pattern characteristics and Doppler filter responses. Additionally, the capability for countering ECM threats within the NFMRAD processor will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0003, FILTERED ESB COVERGLASS DEVELOPMENT
P. Iles, Optical Coating Lab. Inc., *Santa Rosa, California* 95403 (DF461550; F33615-77-C-2035)

The objectives of this program are to fabricate and evaluate improved designs of solar cell coverglass/filter configurations for enhanced cell array survivability to natural and military satellite environments.

Design, fabricate, and evaluate improved filtered/ESB 7070 coverglass-cell configurations. Conduct optical tests and thermal environmental tests to verify filter and ESB integrity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0004, ION IMPLANTATION AND LASER ANNEALING IN SEMICONDUCTORS AND RELATED MATERIALS
J.F. Gibbons, Stanford University, School of Engineering, Dept. of Engineering, *Stanford, California* 94305 (DMR78-19970)

This research will be a study of the effects of laser annealing on removing damage induced in semiconductors by ion implantation. The objective will be to determine the mechanism whereby this occurs, particularly in view of the fact that the annealing does not result in any change in the ion implanted concentration profile. The research will include both experimental and theoretical studies of the recrystallization mechanisms of ion implanted silicon using both pulsed and continuous wave laser annealing.

Work will be initiated to apply the laser annealing technique to other semiconductor systems and metal oxides where thermal annealing is known to produce self-compensation of the implanted species. Another task will involve application of laser annealing to recrystallization of superconductin,; intermetallic compounds. Although fundamental in nature, the results of this work could have a significant impact on the electronics industry.

This grant continues studies initiated under NSF Grant DMR76-18000, and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

4.0005, RELIABILITY ANALYSIS OF GRACEFULLY DEGRADING COMPUTING SYSTEMS
E.J. McCluskey, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DF054970; F49620-79-C-0069)

AF function - digital avionics systems. Important functions in growing numbers are being performed by digital systems on USAF aircraft. The consequent demand for reliable computing require newer and better designs in electronic circuitry. Deficiency - for computers used in real-time applications such as control of aircraft, it is crucial that they function correctly for long periods, and that they be provided with sufficient fail-safe features. Objective - to develop more useful and accurate techniques for the analysis of diverse competing computer systems and component parts, to provide a better understanding of the interrelationships between performance and reliability, and to achieve ultimately better architectures for higher reliability. How work contributes - the results of this research would contribute toward the design and construction of ultra reliable computers which are needed for advanced technology aerospace vehicles.

Several factors in the design of computer systems are to be investigated from the viewpoint of reliability, maintainability, and performance. These include executive routines, hardware failure studies, and fault detection and reconfiguration strategies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, EXPERIMENTAL AND NUMERICAL STUDY OF FLOW IN CURVED DUCTS WITH HEAT TRANSFER
J.A. Humphrey, University of California, Berkeley Campus, School of Engineering, Dept. of Mechanical Engineering, *Berkeley, California* 94720 (ENG78-27007)

Turbulent flow in a curved duct of square cross-section with heat transfer through the outer radius wall is investigated experimentally and theoretically. The duct is relatively tightly curved so as to induce secondary motions due to centrifugal force-radial pressure gradient imbalances. Measurement of the flow is performed by means of a laser-Doppler velocimeter for the velocity and turbulence characteristics and by means of an infrared spectra radiometer for temperature. Detailed mapping of the flow, with and without heat transfer, is made at various stations in the duct. A calculation procedure which has been applied successfully to three-dimensional laminar flows is extended to calculate the experimentally measured turbulent flow. A two-equation model of turbulence is utilized.

SUPPORTED BY U.S. National Science Foundatioe, Div. of Engineering

4.0007, AEROELASTIC OPTIMUM DESIGN OF LIFTING SURFACES WITH ACTIVE CONTROLS

L.A. Schmit, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (DF054030; F49620-79-C-0018)

AF function - advanced flight vehicles will require maximum efficiency from all on-board systems. Opportunity - optimization techniques have been demonstrated for static structural behavior but have not been fully considered for aeroelastic responses in conjunction with active control systems. Objective - the objective of this research is to develop an efficient and accurate solution technique for the aeroelastic behavior of minimum weight structures with active controls. How work contributes - the research contributes to the goal of achieving a fully automated optimum design procedure for aircraft.

Highly efficient modern aircraft are designed for maximum flight efficiency and minimum weight. Initially, all strength conditions are satisfied by the design. Subsequently flutter margins are analyzed with either stiffness increases or mass balancing utilized. In addition, recent developments have used active flight control systems to suppress flutter. This research will expand minimum weight optimization methods to consider aeroelastic phenomena and active control techniques. Two basic approaches will be followed by this effort: first, a serial approach in which all parameters are considered sequentially, second, a parallel treatment of the parameters. Each approach will be considered in solving high and low aspect ratio wing problems for supersonic and subsonic aerodynamic conditions respectively. Solutions and solution procedures will be compared in terms of accuracy and computational efficiency.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, CHARACTERISTICS OF AN INTEGRATED OPTICS RING-INTERFEROMETER FOR LASER GYRO APPLICATION

E. Garmire, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF055580; F49620-79-C-0113)

AF function - navigation, guidance and control of aircraft, spacecraft and missiles require sensors of angular rotation rate in inertial space. However, conventional gyroscopic sensors pose cost and adaptation problems. Opportunity - although the coming use of ring lasers in strapdown systems will offer considerable advantages,proper use of new integrated optics and integrated circuit advances will minimize the cost and maximize the adaptability and availability of these new sensors which allow the direct measurement of absolute inertial rotation rate without requiring comparison with other standards for calibration. Objective - the intrinsic limitations of ring lasers are to be avoided by new approaches which have the potential for integrated optics implementation and high performance cost ratio. How work contributes - this research should lead to devices which are free from lock-in and bias effects encountered in conventional laser gyros, have high sensitivity and accuracy and allow ready adaptation to specific requirements such as size reduction, cost decrease or sensitivity increase and adaptation to a specific environment and geometry.

Investigation of the feasibility of a new solid state laser optical inertial rotation sensor which uses a passive ring resonator as the sensing element and two independently controlled laser frequencies to read out the lengths of the clockwise and counterclockwise paths of the resonator. Because the laser is outside the ring solid state lasers and thin films waveguides may be used, which would make the gyroscope small in size and conducive to microoptic fabrication. This effort considers the solid state implementation of the previously explored MIT passive ring resonator gyro concept and focusses in its first phase on experimental and theoretical studies of making highest finesse single mode integrated ring interferometers using glass or fused silica. In particular, electrical-thermal migration of ions will be used to make thick, buried, ultra low loss single mode planar waveguides.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, EXPERIMENTAL INVESTIGATION OF SUPERSONIC JET NOISE

R.E. Kaplan, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (ENG76-22529 A01)

The primary aim of this project is to determine whether the large-scale, coherent structures contribute significantly to the radiated noise of a supersonic jet. Measurement of the far-field noise radiated from a fixed region of the jet will be made to correlate this data with near-field measurements and to identify the latter with the turbulent jet structure.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0010, INVESTIGATION OF JUNCTION FIELD EFFECT TRANSISTORS

K. Lehovec, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (ENG76-84530 A01)

The objective of this program is the electrical characterization of the interface between a semiconducting channel and an insulating substrate to determine those electrical parameters which are of importance for field effect transistor design. The semiconductor-substrate combinations to be studied are silicon on sapphire, and semiconducting gallium arsenide on semi-insulating gallium arsenide.

The Shockley-Read-Hall parameters pertaining to the surface states at the silicon-sapphire interface will be derived by (1) applying and extending the transient current method recently developed under this program and (2) by using the standard metal-oxide-semiconductor capacitance-voltage and resistance-voltage methods in conjunction with the metal/sapphire/interdigital silicon test structure developed in the program.

The gradual transition between an ion-implanted n-channel and a chromium-doped semi-insulating gallium arsenide substrate will be studied using distributed network analysis and the dual bias method for determining impurity profiles. The latter method eliminates the ambiguities arising from capacitance-voltage measurements with nearly pinched-off channels. This is a continuation of research under NSF grant ENG-7405551.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0011, KINETIC RATE CONSTANTS OF IMPORTANCE TO KRF AND ARF RARE-GAS-HALOGEN LASERS

G.J. Collins, Colorado State University, School of Engineering, Dept. of Electrical Engineering, *Fort Collins, Colorado* 80523 (ENG77-21625)

This research concerns a novel technique to measure excited state reaction rates of importance to the argon fluoride and krypton fluoride lasers. The novel technique involves measuring the radiative lifetimes of the upper laser levels of both ArF and KrF molecules and determine several collisional quenching rates. These quenching cross sections are of crucial importance to an understanding of high pressure electron beam and TEA

discharge excited ArF and KrF lasers where the possible products of reaction, as well as the rates, are presently unknown.

Finally, having measured the rate constants, the He-Ar-RF and He-Kr-RF discharges which are employed in practical TEA, ArF and KrF lasers will be investigated to identify the major excitation mechanisms, the role of helium and determine if the excitation mechanism differs from the simple Kr-RF and Ar-RF mixtures.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0012, DF ROTATIONAL RELAXATION STUDIES
J.J. Hinchen, United Technologies Corp., United Technologies Research Center, *400 Main St., East Hartford, Connecticut* 06108 (DF054170; F49620-79-C-0032)

AF function - improved Air Force operations in communications, reconnaissance and other electromagnetic signal propagation areas require developments in laser technology. Deficiency - there is presently a lack of proper understanding of the laser physics and chemistry in DF chemical lasers and how these affect power output and spectral characteristics. Objective - perform an experimental study to measure relaxation and collisional linewidths of rotationally excited deuterium fluoride gas, and measure V-R transfer. How work contributes -provides information on population differences in specific V, R levels which in turn determine the power for each laser transition in CW lasers and specify time-energy-wavelength relationships for pulsed lasers.

Use IR double resonance technique which employs a pulsed laser to excite HF molecular populations to a particular rotation level and a CW HF laser to probe this or other rotation levels to determine the time dependence of population transfer between levels. Perform these measurements at room temperature and at several values of HF gas pressure. Computer analyze the experimental data to extract specific relaxation rate constants.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, ISOTOPE SEPARATION IN PLASMAS
J.L. Hirshfield, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (ENG76-22430)

An experimental study of multi-ion resonances in a plasma will be initiated with a view towards isotope separation. The effort will attempt to combine the considerable accumulated experience on RF heating of ions in a plasma and recent work indicating that copious production of metal ions can occur in laser-initiated arcs. The investigation will explore the possibility of developing a new class of electromagnetic isotope separators. The underlying view in this work will not be to evolve a design for a separation unit per se, but rather to attempt to understand the basics to an extent that reasonable guesses can be ventured as to feasibility.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Chemical & Process Engineering

4.0014, FUEL STORAGE EMISSION CONTROL
T.B. Stauffer, U.S. Dept. of Defense, Air Force, Engineering & Services Center, Engineering & Services Lab., *Tyndall Air Force Base, Panama City, Florida* 32403 (DF336580)

To determine the specific emission standards the AF must meet for hydrocarbon vapor emissions from underground JP-4 storage tanks and develop appropriate control devices to fulfill compliance. Some AF bases in Southern California may not meet local air pollution criteria. The entire AF-wide problem will be investigated and currently available control devices evaluated in terms of abatement requirements. Information obtained in the study should permit selection of devices that meet local air pollution control requirements.

The extent of the Air Force problem will be determined. Types of devices that will control evaporative hydrocarbons to required levels will be identified. Currently available control devices will be evaluated for achieving compliance with applicable regulations. If no currently available devices will control JP-4 emissions, new systems will be developed. The final technical report will be widely distributed to make selection criteria readily available to base civil engineers and environmental coordinators.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0015, ELECTRON BEAM CONTROLLED GAS LASERS
T.A. DeTemple, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (ENG75-21515 A01)

The use of electron beams as an aid in obtaining laser operation at high pressures is now a demonstrated technique. Direct beam excitation has been employed in rare-gas halide lasers, charge exchange lasers and rare-gas molecular lasers. Alternately using the beam as an ionizer with the predominate excitation coming from a conventional energy storage sustainer supply has resulted in substantial performance from CO and CO2 infrared lasers.

This research program concerns the use of an ionizer-sustainer mode of operation as a means of studying laser action at high pressures with the general goals of seeking new transitions and obtaining enhanced performance from known transitions. In addition extended electron diagnostic experiments and optical pumping experiments will be conducted.

This research is a continuation of a program previously supported under National Science Foundation Grant No. ENG-7521515.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0016, STABILITY AUGMENTATION SCALING
R.L. Fanin, General Motors Corp., *4700 W. 10th St., Indianapolis, Indiana* 46206 (DF457340; F33615-75-C-2044)

The objective of this effort is to establish the usefulness of local metal matrix composites to increase the vibration stability of fan/compressor blades.

This program consists of five tasks. Task I is a design and analysis effort to parametrically define the influence of locally stiffening turbine engine fan/compressor blades using metal matrix composite inlays. Task II establishes the manufacturing processes to produce a low cost, reproducible blade. Task III includes the fabrication of fan/compressor blading with the composite panel inlays. Task IV emphasizes the verification of frequency, mode shape and strength characteristics using Task III hardware. Task V covers the instrumentation, assembly and piggyback engine testing of a full stage of composite inlaid blades. Additional AMST and experimental flight testing is scheduled to structurally verify the Ti metal matrix in the engine environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0017, CALCULATION OF BOUNDARY LAYER EFFECTS IN SUPERSONIC MIXED-COMPRESSION INLETS AT ANGLE OF ATTACK
J.D. Hoffman, Purdue University, School of Engineering, Dept. of Mechanical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (NSG 3311)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0018, AEROSOL FILTRATION BY FIBROUS FILTERS
T. Ariman, University of Notre Dame, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Notre Dame, Indiana* 46556 (ENG77-09387)

A coordinated analytical and experimental research program will be conducted on fibrous filtration in an electrostatic field. The investigation will be based on a model fibrous filter with a staggered array arrangement of fibers. The major objective of the research is the development of the fundamental and predictive relationships for the collection efficiency as well as the pressure drop in fibrous filtration in an electrostatic field for the staggered-array fibrous filter model. In the experimental part of the research, a number of experiments will be performed using fibrous filters of uniform sized fibers and monodispersed aerosols in an electrostatic field and the fundamental relationships for the collection efficiency as well as the pressure drop will be evaluated.

Particles smaller than 3 microns aerodynamic diameter are the most difficult to collect with the available techniques and equipment. Unfortunately, fine particles also have a much greater impact on public health, visibility, and cloud nucleation when compared with the same weight of larger particles. It is expected that the outcome of the research will be utilized in the controlling of fine particles.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0019, AERODYNAMICS OF CASCADED AIRFOILS OSCILLATING OR SUBJECT TO THREE DIMENSIONAL FLOW DISTURBANCES

H. Atassi, University of Notre Dame, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Notre Dame, Indiana* 46556 (DF053760; F49620-79-C-0014)

AF function - advanced turbomachinery. Opportunity - improve capability to predict unsteady aerodynamic forces on turbomachine blading systems. Objective - analyze the nonstationary aerodynamic properties and the aeroelastic stability of a row of loaded blades in a subsonic flow. How work contributes - will increase our basic understanding of nonlinear effects in unsteady aerodynamics.

Two distinct problems will be investigated. The first one deals with the stability analysis of oscillating airfoils in a cascade. The research will concentrate on applications to discern and identify the important aerodynamic and aeroelastic properties of highly loaded cascades. The other problem deals with the response of a cascade of airfoils to three-dimensional flow disturbances. Three-dimensional effects cause distortion of the magnitude, phase and wavelength of the oncoming vortical wave as it interacts with the airfoil. The proposed research will be directed at determining the resulting non-stationary aerodynamic forces and moments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, DEVELOPMENT OF A DIODE LASER FLUORINE ATOM DIAGNOSTIC

C.E. Kolb, Aerodyne Research Inc., *Bedford Research Pk., Bedford, Massachusetts* 01730 (DF055340; F49620-79-C-0107)

AF function - this effort will experimentally devise fluorine atom diagnostic techniques of importance to major Air Force development programs in chemical lasers and other areas. Opportunity - the proposed technique using a tunable diode laser offers a unique opportunity for providing a simple usable fluorine atom diagnostic. Objective - to investigate, analyze and demonstrate the use of a tunable diode laser absorption technique as a fluorine atom diagnostic in chemical laser and other systems. Contributions - the AF will make extensive use of the diagnostic technique demonstrated, if this research is successful.

A tunable diode laser in the wavelength region of 404 wave numbers will be used to demonstrate and measure absorption by the ground state fine structure states of the fluorine atom. Measurements will be made on a flowing discharge fluorine atom generating apparatus and data taken will be used to analyze and document the use of such absorption measurements for the purpose of fluorine atom concentration measurements in hydrogen fluoride lasers and other facilities where such a diagnostic technique is important.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, MODE-MEDIUM INTERACTION STUDIES FOR CW LASERS

S. Glicker, Avco Corp., Everett Research Laboratory Inc, *2385 Revere Beach Pkwy., Everett, Massachusetts* 02149 (DF056290; F49620-79-C-0195)

AF function - advanced weapons concepts. Deficiency - the capability does not exist to quantitatively model the undesirable unsteady phenomena high power continuous-wave lasers have exhibited in the near field-unsteady power output and unsteady phase fronts. Objective - to devise a model to relate the laser design properties to the unsteady performance so that the effect of variations in the laser parameters on nonsteady performance can be ascertained and the means provided to study ways to minimize the nonsteady phenomena. How work contributes - the unsteady phenomena discussed lead to a reduced laser flux at a target. To obtain the design performance, an order of magnitude increase in dwell time or aperture power would be necessary to overcome these effects. Alternatively, developing theoretical means for modeling the unsteady phenomena would permit the relatively inexpensive (compared with empirical approaches) investigation of ways to minimize the deleterious effects on laser performance.

Based on the previous development of a model for the acoustic or transverse mode-medium instability for a continuous wave carbon dioxide electric discharge laser, research will be directed at extending the model to the longitudinal or downstream-steering mode. The nonlinear model will be used to investigate the range of laser parameters which result in acceptable beam quality. Also, based on the flow equations applicable to a supersonic laser, a model will be formulated to describe the alignment sensitivity of the optical axis to perturbations in flux, gain, and density. The effect of heating on the density profile and its propagation along characteristics shall be included. This model will be used to assess the influence of a variation of key laser design parameters on power and beam quality.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, APPLICATION OF ARRAY PROCESSORS AND SPECIALIZED COMPUTERS TO NUMERICAL FLUID MECHANICS

W.T. Thompkins, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 3309)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0023, INP METAL CONTACTS

G.Y. Robinson, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Electrical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DF903750; F19628-77-C-0204)

AF function - communications. Deficiency or opportunity - the properties of metal contacts on indium phosphide are inadequate and the mechanisms involved not well understood presently. Objectives - to develop an understanding of the electrical and metallurgical properties of the metal/InP system that will enable a superior contact to be formed. How research contributes - an understanding of the metal/InP interface will allow proper design of detectors operating beyond .94 (microns) for fiber-optic communications systems.

Auger electron spectroscopy combined with barrier energy measurements, contact resistance measurements, and visual evaluation by scanning electron spectroscopy will be used to obtain metallurgical, chemical and electrical analysis of the metal/InP interface.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0024, II-IV-V2 CHALCOPYRITES FOR HIGH-SPEED DEVICES

C.M. Wolfe, Washington University, School of Engineering & Applied Science, Dept. of Electrical Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (DF054860; AFOSR-79-0096)

AF function - microwave solid state electronic devices are essential components of Air Force reconnaissance, electronic countermeasures and communications systems. Opportunity - Air Force systems needs continue to demand improvements in frequency, power, bandwidth, noise performance and efficiency in solid state electronic devices. Currently GaAs, InP, and III-V ternary and quaternary alloys of various composition are being investigated because of their high electron mobility, high saturated velocity and transferred electron effects. The II-IV-V2 chalcopyrites offer similar parameters but without the disadvantages of low thermal conductivity and other effects caused by random alloy scattering. Objective - to develop suitable growth techniques for ZnGeAs2 on GaAs or Ge, CdSnP2 on InP, and determine the suitability of these materials for application in high speed devices. How work contributes - successful completion of this effort could lead to new or improved types of microwave device materials.

Epitaxial layers of CdSnP2 will be grown on InP substrates in a liquid-phase epitaxial system using elemental Cd and P as initial sources in a Sn solution. Variations in melt temperature, melt composition, and cool-down rate will be accomplished to obtain good quality epilayers. Epitaxial layers of ZnGeAs2 will be grown on GaAs or Ge substrates in a vapor phase system using elemental Zn and Ge, and AsCl3 as a source of As and Cl to transport the Ge. Variations in source and substrate temperatures and flow rates will be made to obtain good quality epilayers. Investigation of intentionally added dopants will be performed in both types of materials. Other technologies including that for forming ohmic contacts and Schottky barriers, and the development of etchants for the delineation of interfaces and defects will also need to be developed so that the resulting layers can be characterized.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0025, SPARK IGNITION OF LIQUID FUEL SPRAYS
C.E. Polymeropoulos, Rutgers the State University of New Jersey, New Brunswick Campus, School of Engineering, Dept. of Mech Aerospace & Industrial Engineering, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (ENG76-15603)

The research covers an experimental study of the minimum spark ignition energy of liquid fuel sprays. The study will examine fundamental parameters, and will employ primarily monodisperse sprays and laminar flow. The effect of droplet size, air-fuel ratio, and flow velocity on minimum spark ignition energy will be assessed. Holographic observations of the expanding spark kernel will furnish information on the effect of kernel development on particle concentration. Existing methods for the estimation of the fraction of spark energy that is useful for ignition will be employed. The critical spark and mixture conditions for ignition will be correlated using available heat balance models at the critical kernel size, adapted for the presence of droplets.

Monodisperse tetralin sprays will be employed to identify the quenching distance as a function of droplet diameter for a range of flow velocities and air-fuel ratios. The spark discharge time will be optimized in terms of obtaining the smallest ignition energy for each droplet size. The effect of the expanding spark kernel on the distribution of droplets around the igniter will be assessed using high-speed holography. Finally, measurements of minimum spark energy for ignition obtained using polydisperse sprays will be carried out, and the results will be interpreted in terms of the monodisperse spray results. To aid the interpretation and presentation of experimental data, existing concepts of the thermal balance at the critical kernel size, which were developed for homogeneous mixtures, will be employed for deriving similar relations for heterogeneous mixtures. In addition, the fraction of spark energy useful for ignition will be estimated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0026, SIGNAL PROCESSING ARCHITECTURE STUDY
V. Eveleigh, Syracuse University, L.C. Smith College of Engineering, Dept. of Electrical & Computer Engineering, *Link Hall, Syracuse, New York* 13210 (DF920520)

The objective of this effort is to apply multi-level computer simulation to the design and verification of signal processor architectures optimized to the requirements of radar and electrooptical sensors located on space platforms.

The framework of this effort will be a design trade-off study using computer simulation to investigate signal processor architectures in context with physical design goals and a broad range of mission requirements. The flexibility of the processor architecture and the survivability of its software, independent of evolving device technologies or modifications of mission requirements, will be emphasized.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0027, IN HOUSE MEASUREMENTS PROGRAM
D.W. Hanson, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF740510)

Air Force function - this effort supports research to improve the space object characterization and mission assessment capability of the USAF. Deficiency - high resolution imagery of space objects cannot be obtained from ground based sensors, due to optical phase aberrations caused by turbulence in the earth's atmosphere. Mission assessment and identification of spacecraft must therefore depend on other than high resolution imagery. Objective - to measure atmospheric and optical propagation parameters. How research contributes - the data obtained will be used to verify existing theoretical analyses and to provide design parameters for compensated imaging systems.

Theoretical considerations will be used to establish a priority on parameters to be measured. Existing scientific packages at the Verona Test Site will be used to make the required measurements. The coelostat and one meter telescope gives the Verona facility the capability of extremely accurate positioning, limited tracking, and making both up and down path measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0028, GAS CORRELATION FOR HYDROCARBONS
D.E. Burch, U.S. Environmental Protection Agency, *Research Triangle Park, North Carolina* 27709 (DF336420)

To determine the feasibility of using a gas correlation method for the remote (non-contact) sensing of hydrocarbon pollution generated by Air Force operations. Presently available point monitoring sensors have proven unreliable or inappropriate for determining the contribution of airfield operations to local environmental quality. A remote system would provide an integrated pollutant load.

Joint funding with EPA. An existing gas correlation instrument will be modified to sense hydrocarbons. High resolution spectra will be furnished by the EPA project officer for use by the contractor to determine the most promising approach.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0029, TURBINE ENGINE LUBRICANT DEVELOPMENT
G.A. Beane, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451060)

Develop new lubricants and define requirements for current and proposed turbine engine and power generation systems.

Provide engine lubricant requirements to industry in terms of physical properties and performance criteria. Conduct oil testing laboratory and full scale engine to ensure oils meet these requirements, and to study advanced lubricant capabilities. Evaluate the toxicological characteristics of lubricant formulations and additives considered suspect.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0030, ENVIRONMENTAL IMPLICATIONS OF ALTERNATE FUELS
T. Jackson, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF409540)

To determine the changes in the quality and quantity of pollutants emitted by various blends of potential AF alternate jet fuels when burned in three different combustor types or utilized in various AF fuel handling systems.

Up to twelve different blends of potential AF alternate jet fuels will be burned in three different combustor types (low pressure can, high pressure can, and high pressure annular) to determine the changes in the quality and quantity of emitted pollutants (NOx, CO, smoke, and UBHC). Certain physical and chemical properties of the fuel blends will also be determined. The work will be accomplished by the AFAPL through multiple contracts with industry. The appropriate AFAPL JONS are as follows. 30480581 (low pressure can), 30480584 (high pressure annular), and 30480595 (high pressure can). A CEEDO/AFAPL technical report will be published for each of the anticipated three contracts to be performed during this program.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0031, EXCITATION STUDIES AND MASS SPECTROMETRY OF PLASMAS
J.F. Prince, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458830)

AF function - communication, weaponry, illumination, R.F. effect in communications, nuclear weapons effects. Deficiency - lack of knowledge on excitation, ionization and dissociation processes in gas discharge lasers and the upper atmosphere especially under energetic conditions. Research - mass analysis of gas discharges relevant to molecular gas discharge lasers. Direct and cumulative excitation cross-sections. How research contributes - improved gas discharge laser systems and improved understanding of atmospheric processes.

A modulated molecular beam mass spectrometer is used to monitor the relative and absolute concentrations of various molecular species existing in typical laser plasmas. Neutral, ionic, and reactive species are measured under carefully defined plasma conditions. Time resolved observations of the species concentrations allows direct analysis of dissociation and association rates. Phase sensitive detection of the modulated beam and use of a low energy, efficient ionizer assures unambiguous measurement of the true plasma ions and neutral concentrations. Direct and cumulative excitations of atomic and molecular gases are measured using a dual electron beam system interacting with a molecular beam. A high speed pumping system allows measurement of these cross-sections in dissociating gases. Photon counting, synchronous detection, and sophisticated digital data handling techniques are used to obtain and analyze reliable data. A low energy electron analyzer permits direct measurement of elastic and inelastic scattering of electrons by atoms and molecules. This instrument has a resolution of better than 0.03 eV and is capable of resolving resonant states of atoms and molecules. Data from these experiments is used to improve existing theoretical models of non-equilibrium plasmas and to aid in the analysis of the plasma properties of discharge lasers. Direct and cumulative excitation and ionization measurements lead to a better understanding of the effects of natural and man-made ionospheric disturbances.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0032, COMPRESSOR RESEARCH FACILITY INSTRUMENTATION AND DATA ACQUISITION
Unknown, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF463700)

To establish and maintain a state-of-the-art capability for the measurement, collection, and processing of CRF facility and test article related performance parameters, and to advance the state-of-the-art in related instrumentation and measurement techniques.

To establish and maintain close communication and working relationship with the engine testing community and to anticipate future needs and establish in-house or contracted R&D programs directed toward the solution of unique or advanced instrumentation concepts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0033, LIFE CYCLE COST OF SIMULATED VS ACTUAL AVIONICS MAINTENANCE EQUIPMENT FOR THE F-16 TRAINING PROGRAM
F.T. Eggemeier, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF228260)

To compare the life-cycle cost of F-16 avionics intermediate level training when conducted on simulated vs. actual aircraft and maintenance equipment. The results of the analysis will be a factor used by the F-16 System Program Office (SPO) to decide if a training simulator should be procured. The information provided by this study could also potentially impact on the cost and training effectiveness of other planned and existing systems. This analysis was requested by the F-16 SPO. The final product of this program will be a life cycle cost technical report.

This program is being conducted in two phases. Phase I (completed dec 76) was a general comparison of estimated life cycle costs for each type of equipment and was conducted in-house by AFHRL/AS. Phase I provided early estimates of the general configuration of the simulated equipment required to accomplish the training objectives and a general comparison of systems costs. Phase I results provided input for initial decisions about equipment procurements and were used to decide if a more detailed life cycle cost comparison was warranted. Since Phase I supported the use of simulated equipment, Phase II (Jul 78-Jul 79) is being conducted. Phase II is a detailed life-cycle cost comparison which will be based on the more extensive training and test station information scheduled to be available during that period.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

4.0034, A NEW MULTIPLIER STRUCTURE FOR DIGITAL SIGNAL PROCESSING
F.J. Taylor, University of Cincinnati, School of Engineering, Dept. of Electrical Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (DF055120; F49620-79-C-0066)

AF function - military aircraft use digital computers as part of their avionics systems, and future control and communications systems will increasingly exploit digital microprocessors. Deficiency - although digital methods have many advantages over the older analog systems, the current costs in money, weight, and electrical power for the new processors do not permit their use as much as would be true if the costs were reduced. Objective - to perfect a new type of digital multiplier which makes use of stored tables and which would be fast, accurate and inexpensive. How work contributes - the results of this research could improve the cost effectiveness of all digital signal processing, i.e., faster and cheaper computer algorithms for automatic control, communications, and radar would be possible.

The principal idea is to exploit the fact that a bilinear form can be expressed as sums and differences of quadratic forms, which means that tables of squares can be used for multiplication. Specific applications will be thoroughly tested, including the adaptive filter and the residue recursive filter.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0035, STRUCTURAL MECHANICS
J.W. Harvey, Oklahoma State University, Agricultural Experiment Station, Dept. of Civil Engineering, *107 Whitehurst Hall, Stillwater, Oklahoma* 74075

The research combined aerodynamic and stress simulation of blades, interfacing existing technology in the separate disciplines with extensions as appropriate to permit automated propulsion gas turbine blade designs.

SUPPORTED BY Oklahoma State Government

4.0036, DEVELOPMENT OF NEW INTERCALATED CATHODE MATERIALS IN USE IN SODIUM BATTERIES

W.L. Worrell, University of Pennsylvania, School of Engineering & Applied Sciences, Dept. of Metallurgy & Materials Science, *4001 Spruce, Philadelphia, Pennsylvania* 19104 (NSG 3300)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0037, ENGINEERING ASPECTS OF PLASMA WAVES

I. Alexeff, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Electrical Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (ENG78-03400)

An experimental and theoretical investigation of certain wave and particle problems in plasma dynamics is under investigation. Topics being studied include: 1. The effects of plasma boundaries on the absorption and reflection properties of ion-acoustic waves; 2. The characteristics of cold electrons injected in the troughs of ion-acoustic waves; 3. The potential effectiveness of time-of-flight isotope separation in a plasma separator; and 4. Ignition and turn-off characteristics of plasma discharges in high voltage switching.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0038, RESEARCH ON NUMERICAL ALGORITHMS FOR THE THREE-DIMENSIONAL NAVIER-STOKES EQUATIONS

A.J. Baker, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Engineering Science & Mechanics, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DF143080)

This work will produce a novel technique for the solution of the turbulent flow of a compressible fluid about aerodynamic bodies and will greatly impact the Air Force mission of flow field prediction. The accuracy and economy of the numerical algorithms developed under this research will be evaluated. The goal of the work is to derive, implement and evalaate numerical algorithms for the solution of the three-dimensional Navier-Stokes equations for turbulent compressible fluid flow. Employment of these standardized computer algorithms in the design phase of new aerospace systems may greatly decrease the wind tunnel testing requirements and thereby shorten their design cycle, improve their accuracy and reduce their cost.

Finite element interpolation theory will be used to develop a factored Jacobian computer algorithm for the solution of the nondimensionalized conservative form of the steady state time averaged Navier-Stokes equations for turbulent fluid flow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0039, ELECTROMIGRATION IN ALUMINUM ALLOY FILMS

P.B. Ghate, Texas Instruments Inc., *13500 N. Central Expy., P.O. Box 5621, Dallas, Texas* 75222 (DF912230; F30602-78-C-0186)

The objective of this study is the development of fundamental physical information needed to assess and predict the electromigration of thin film binary and ternary aluminum alloys used as solid state device interconnection paths.

Test structures incorporation alluminum alloy conductive films will be coated with deposited dielectric layers and subjected to a series of current density and temperature stress. Information will be obtained on the rates of electromigration failure due to both open conductor stripes and resistance changes due to dopant atom redistribution. These failure mechanisms will be related to stripe composition and geometry and also the integrity of the overlying dielectric layer. Study results will be combined with existing information on silicon doped aluminum films and used to develop improved test methods and specifications for high reliability microelectronic devices. The end item will be a report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0040, COMPLEX TURBULENT FLOWS

L.S. Kovasznay, University of Houston, Graduate School, *3801 Cullen Blvd., Houston, Texas* 77004 (DF056490; F49620-79-C-0227)

AF function - aerospace vehciles. Deficiency - turbulent flow fields are only partially understood, the interactions between turbulent shear flows of different turbulence structure is even less understood. Objective - to increase the understanding of the interactions when two turbulent streams of different turbulent structure mix. How work contributes - increased understanding of this flow situation will aid in the design of advanced aerospace vehicles in the area of jet augmentation systems, the mixing of fuel and oxidizer streams for combustion, nozzle arrays in laser cavities, stability or decay of wakes and wake vortices, the stability of boundary layers, boundary layer separation and other.

An experimental investigation of the behavior of the large scale structures of axisymmetrical flow streams when different turbulence structures are initially present within the interacting streams will be performed. The results of these interactions will be compared to existing prediction methods of the transport properties and new modeling methods will be proposed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0041, PROTECTION OF ADVANCED ELECTRICAL POWER SYSTEMS FROM ATMOSPHERIC ELECTROMAGNETIC HAZARDS

Unknown, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF463260; F33615-79-C-2006)

Determine the vulnerability of advanced aircraft electrical power systems to lightning induced transients and develop cost-effective protection techniques to minimize electrical power system failures and reduce transients injected into aircraft equipment by the electrical power and distribution wiring.

State-of-the-art analytical techniques will be used to determine electrical power generation and distribution system and system component vulnerabilities. Trade studies will be conducted between viable protection techniques to determine cost and performance impact of alternative protection schemes. Design guidelines will be developed for electrical power system protection for advanced aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0042, APPLICATION OF FUNCTIONAL ANALYSIS IN FLUID MECHANICS

L. Napolitano, Universita degli Studi di Napoli, *1 Corso Umberto, Naples, Italy* (DF054480; AFOSR-79-0055)

AF function - advanced aerospace vehicles. Opportunity - to provide improved design and analysis computational tools suitable for the development and evaluation of future, high performance Air Force aerospace vehicles. Objective - to develop a new class of spline functions applicable to interpolation and/or smoothing problems for closed curves (one-dimensional spline) or closed surfaces (two-dimensional spline). How work contributes - in computational aerodynamics it is often necessary to solve interpolating problems for closed curves. Using classical splines for such cases is, in general, unsatisfactory due to problems arising at the closure point. This work has potential application in computational fluid dynamics to geometry specification and grid handling for complex geometric shapes representative of realistic flight vehicles.

The research will apply functional analysis in order to define and study various classes of closed spline functions. This will involve the definition of the spline functions as solutions of appropriate minimization problems in Hilbert spaces. A number of optimization and trade-off problems associated with applications of the splines will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0043, ENERGY CONVERSION - AIR BREATHING ENGINES SYMPOSIUM
J. Swithenbank, University of Sheffield, *Mappin St., Sheffield, England, United Kingdom* (DN475335; N00014-76-G-0026)

This work unit, giving partial support for the Third International Air Breathing Engines Symposium will be instrumental in providing interaction between research and development efforts of the participating countries and groups concerned with utilization of air breathing engines relative to aircraft and missile applications. As part of the energy conversion subelement, this effort gives support to all work units under the Navy's energy utilization task.

Activities of the third symposium to be conducted by the chief investigator with the assistance of an organizing committee and international representatives, will include the following: (a) organization and operation of the symposium, to be held 7-12 March 1976 in Munich, Germany (Holiday Inn) and (b) publication, in book form, of the symposium proceedings.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0044, ANALYSIS OF DAMAGE EFFECTS IN THE FATIGUE LOADING OF STRUCTURAL COMPOSITES BY MEANS OF REAL-TIME MOIRE INTERFEROMETRY
C. Walker, University of Strathclyde, *Glasgow, Scotland, United Kingdom* (DF289770; AFOSR-78-3719)

This research will help fill the need for a method to investigate failure mechanisms in composites for structural components. Not only will a new technique be developed but also greater insight into the fracture process will be achieved.

A new method of real-time in-plane strain visualization and measurement will be used to investigate mechanisms of failure and load redistribution in composite materials typical of those used for aircraft structures. The experimental technique, which has been developed at CII, University of Strathclyde, depends upon a grid attached to the specimen, and an interferometer which senses changes in the grid deformation. The object of the study is both to provide a greater understanding of mechanisms in composites, and to demonstrate the range of a potentially useful monitoring technique.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, TEMPERATURE AND WINDS IN THE DISTURBED HIGH LATITUDE IONOSPHERE
M.H. Rees, University of Alaska, College Campus, Geophysical Inst., *Bunnel Memorial Bldg., College, Alaska* 99735 (ATM77-23141)

This grant supports a two-year program to carry out measurements of the neutral gas temperature and the ion and electron temperatures in the geomagnetically disturbed high latitude ionosphere. The neutral temperature will be deduced from Doppler profiles of forbidden lines of atomic oxygen, measured with a Fabry-Perot interferometer. The ion and electron temperatures will be obtained from measurements made with the Chatanika incoherent-scatter radar. A band of the N 2 plus 1NG system will be measured with the Poker Flat spectrophotometric facility to deduce energy input rates by particle bombardment, as well as obtain the rotational temperature of the band, which is essentially equal to the kinetic temperature of the neutral gas. The observations will be analyzed in terms of aurorally associated joule and particle heating of the ionized and neutral gases by appropriate modeling.

Measurements of E- and F-region neutral winds will be undertaken using the Fabry-Perot interferometer to observe Doppler shifts of the 01 auroral emission lines. These results will be compared with ion drift measurements deduced from radar observations. Neutral wind data provide the essential input to a high latitude thermospheric circulation model, a topic that is just beginning to be explored.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0002, STUDIES OF N (2P0) AND N(2D0) POPULATION RATES IN AURORAS
G.G. Sivjee, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-24837)

The question of odd nitrogen formation and removal is important at all levels of the atmosphere. The question of the method of formation of nitrogen oxide (NO) in some aurorae and in large amounts is of particular importance to the understanding of the aurora.

Several processes in auroras produce nitrogen atoms in 4S0, 2D0 and 2P0 states. Since some chemical reactions involving odd nitrogen proceed at a faster rate when the latter is in an excited rather than in the ground state, a knowledge of the population rates of N(2P0) and N(2D0) is crucial to the understanding of the chemical processes in auroras, especially the production of NO. Lack of precise information about the relative distribution of nitrogen atoms, produced through various auroral mechanisms, among the different electronic states precludes reliable calculation of N(2P0) and N(2D0) in different auroras characterized by precipitation of electrons of different average and total energies. The measurements involve SIMULTANEOUS spectrophotometric observations of numerous spectral emission features in auroras with complementary incoherent scatter radar measurements. Because of the long radiative lifetimes of N(2P0) (approximately 12 sec) and N(2D0) (approximately 26 hrs), measurements of their population rates during particle bombardment of air can only be made in a wall-free environment as in auroras and not in ground-based laboratories.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0003, DYNAMICS AND MICROPHYSICS OF STABLE OROGRAPHIC CAP CLOUDS - COMPARISON BETWEEN THEORY AND OBSERVATION
K.C. Young, University of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (ATM77-04287)

The objectives of this research are two-fold; namely, model development and model verification. Two types of models will be developed. A three-dimensional, dynamical model will be developed in order to describe the flow field over and around Elk Mountain to be used as input into the microphysical model. A three-dimensional, microphysical model will be developed based on an existing two-dimensional model of orographic precipitation. The models will be restricted to cases where the flow within the cap cloud is stable and reasonably steady-state.

Model verification will be undertaken in two stages. First, aircraft observations of the thermodynamic variables and winds will be used in verification of the dynamical model. If the agreement between the model predictions and the observations is felt to be deficient, the observations will be used to improve the predicted flow field.

The predictions of the microphysical model will be compared to airborne and ground-based microphysical observations. Comparisons will emphasize the types and sizes of particles and the precipitation rate at the ground.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0004, SOME AERONOMIC PROBLEMS IN PHOTODISSOCIATION, PHOTOABSORPTION, AND ENERGY TRANSFER
T.G. Slanger, S R I International, Molecular Physics Center, *300 Ravenswood Ave., Menlo Park, California* 94025 (ATM78-07605)

This grant supports basic laboratory studies of molecular processes of importance to Earth's atmosphere. Using a pulsed 1610 A H2 laser as a light source the basic common O (1D) plus 2 energy transfer reaction will be investigated in unprecedented but needed detail. Specifically the kinetics and temperature parameters of this reaction will be determined. The same systems will also be used to measure the rate of the aeronomically important coefficients for quenching O(1D) and O2(b1 sigma g plus) v equals n states by ground state oxygen atoms, processes that may be of considerable atmospheric importance. The laser will also be used to measure O (1D) yields from various aeronomically important triatomic molecules at 1610 A.

Studies will be extended of the atomic products following photodissociation in O2 in the wavelength region below the Schumann-Runge continuum with emphasis on fine structure appearing in the O2 absorption spectrum below 1200 A. The extent of predissociation in the several states of NO, accessible from the ground state at absorption wavelengths between 1500 and 1900 A, will also be measured.

Absorption spectra of the common atmospheric gases are not generally available at elevated temperatures; at 1000 degrees K, calculations show that gases may easily have absorption cross sections three times larger than at 300 K. Such an effect would have considerable impact on modeling calculations, and measurements will be made on all the common atmospheric gases between 1050 A and 2000 A, at temperatures up to 1000 K.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0005, EVALUATION OF RUNOFF DURING PERIODS OF LOW FLOW

W.D. Simons, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *345 Middlefield Rd., Menlo Park, California* 94025 (WR 70-062)

Inflow to reservoirs associated with hydroelectric plants during the low-flow periods (July-April) is an important part of the water supply available for the production of electrical energy. If the amount of reservoir inflows during the drawdown period can be accurately evaluated, then the project can be operated more efficiently and greater use can be made of the available reservoir and bank storage.

To develop a procedure for evaluating potential inflow to selected reservoirs during the low-flow period based on current hydrologic and meteorologic data and conditions, and to determine the historical range in variations of these factors.

Several methods of evaluating the inflows to 'power' reservoirs have been developed previously based on combining recession data with current hydrologic and meteorological conditions. This would be studied for various units of time within the overall July-April period. Data used in these studies would be adjusted as needed, to reflect 'current' conditions. Step-regression analyses would be used to composite upstream data to downstream locations.

During the period July-April weekly summaries of runoff potentials for one to four months in advance were prepared and sent to Bonneville Power Administration. These are based on weekly runoff reports from Northwest Water Resources Data Center. Additional statistical data developed for some of the upstream stations were used. Comparison with observed runoff values for Grand Coulee, Ice Harbor, and the Dalles Dams has been started. Limited view was made of changes in irrigation development and modified flows for 1975 level of development.

Prepare a comparison of projected and observed runoff for both upstream and downstream locations.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Water Resources Div.

5.0006, INVESTIGATIONS OF HIGH-LATITUDE IONOSPHERIC ABSORPTION

H.J. Chivers, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (DPP76-80556 A01)

The objective of this research is to investigate the detailed processes controlling the interactions of the magnetosphere and the ionosphere. The investigations will be made using observations made with a network of newly developed riometers which measure the ionospheric absorption of cosmic radio noise at Siple, South Pole, and McMurdo Stations in Antarctica and at Roberval and Frobisher Bay in Canada. Ionospheric absorption profiles will be compared with simultaneous ground-base and satellite observations of VLF phenomena and magnetic and photometric effects.

The Principal Investigator will visit McMurdo, South Pole, and Siple Stations in Antarctica in the austral summer of 1976/77 and 1977/78.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

5.0007, A KINETIC THEORY APPROACH TO THE MAGNETOSPHERIC ELECTRIC FIELD

E.C. Whipple, University of California, San Diego Campus, Graduate School, Dept. of Atmospheric Science, *P.O. Box 109, La Jolla, California* 92037 (ATM77-04857 A01)

This grant will support an effort to develop a model for the magnetospheric convection electric field, based on kinetic theory. The work will use McIlwain's approach in following particle trajectories in the magnetic equator but will be extended to include non-equatorially mirroring particles. Data from the ATS-5 and ATS-6 satellites will be used to guide the theoretical work, particularly with respect to the location of particle sources and sinks, and as a test of the reasonableness of assumed particle distribution functions. Initially, the steady-state collisionless problem will be treated, but these restraints will be relaxed in later phases of the work. The aim of this work is a description of the macroscopic electric and magnetic fields in the magnetosphere.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0008, ROCK MAGNETISM - TEMPERATURE DEPENDENCE OF HYSTERESIS PROPERTIES OF TITANOMAGNETITES AND OCEANIC BASALTS

M.D. Fuller, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geological Sciences, *Santa Barbara, California* 93106 (EAR78-03325)

This project is an extension of earlier efforts to understand the nature of thermo-remanent magnetization, TRM, and the single domain/ multidomain transition. The principal experiments are: (1) Continuation of studies of the temperature dependence of (a) hysteresis properties, (b) reversible susceptibility. (2) Acquisition and thermal demagnetization of TRM, with special emphasis on the region near to the Curie point, and attempts to observe magnetic shielding effects. (3) A search for magnetic annealing effects in specimens carrying TRM acquired in varying field strengths.

These experiments will be carried out with synthetic titanomagnetites and with DSDP (Deep Sea Drilling Program) oceanic basalts. Work of this type is a necessary step in placing paleomagnetic studies, in particular intensity estimates, on a better theoretical footing.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0009, ATMOSPHERIC RADIATIVE TRANSFER AND ATOMIC PROCESSES

A.E. Green, State University System of Florida, University of Florida, School of Engineering, Dept. of Aerospace Engineering, *220 Black Hall, Gainesville, Florida* 32611 (ATM75-21962 A03)

This grant will fund research into a variety of problems. These include: 1. Theoretical atmospheric radiative transfer calculations. These calculations deal with multiple scattering processes in a variety of environments including a partially obscured

sky. 2. Experimental atmospheric radiative transfer measurements. These measurements will be used to check the validity and accuracy of the radiative transfer calculations. Few measurements of this type have been made in the past. These relatively simple measurements should enhance our knowledge of the intensity of ultraviolet radiation in the lower atmosphere. 3. Atomic calculations for aeronautical applications. This work will continue the calculation and the 'cataloging' of electron collision cross sections of aeronomic interest.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0010, OPTICAL OBSERVATION SMOKE TRAILS
H.D. Edwards, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (DF580160; F19628-78-C-0077)

AF function - to gain quantitative understanding of stratospheric dynamics needed to predict environmental effects of af aircraft and missile operations in and through the stratosphere. Deficiency -reliable prediction of emission effects from supersonic aircraft and missile operations. Research - measurements of transport processes by observation of smoke trails. How research contributes - will provide the data to define and model transport mechanisms.

Photographic observations of upper atmosphere or stratospheric smoke releases provide data relevant to the physical state and motion of the stratosphere or lower thermosphere. Of special interest are smoke trail positions, drifts, and growth, from which ambient winds, wind shears and divergences are determined by photographic triangulation. The results of these studies provide improved physical models of the atmosphere in the natural and disturbed state, as well as data on winds, wind shears and turbulence at supersonic aircraft operating altitudes.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0011, COORDINATED OBSERVATIONS OF LOWER THERMOSPHERICAL CIRCULATION
R.G. Roper, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (ATM76-81558)

This grant funds coordinated observations of lower thermospheric circulation being carried out by a global network of meteor wind facilities and incoherent scatter radars. It also funds the collation, interpretation and publication of the results as they pertain to global neutral atmosphere motions in the height range 80 to 120 kilometers, with due regard being given to interaction with the lower and higher atmosphere.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0012, DEVELOPMENT OF INTRODUCTORY COURSE IN REMOTE SENSING AND INTERPRETATION AND ANALYSIS
C.A. Budelsky, Southern Illinois University, Carbondale Campus, School of Agriculture, Dept. of Forestry, *Carbondale, Illinois* 62901 (SER78-00010)

This project is designed to provide an opportunity for undergraduate students, majoring in the natural resource sciences at Southern Illinois University, to develop functional skills in remote sensing techniques. Remote sensing has been shown to provide significant advantages in collecting and interpreting inventory data over large geographical areas at a substantial reduction in time and expense.

An introductory course will be developed, utilizing the facilities of a currently acquired remote sensing laboratory, to increase the assortment of inventory and diagnostic skills that are needed by students of the natural sciences. The multidisciplinary nature of the student enrollment will be utilized to enhance the development of all class members. Faculty representatives of several departments and undergraduate students will function in an advisory capacity to identify pertinent topics for inclusion, so that the presentation will be relevant to the needs of the students. Consultants from the University's Learning Resource Center and from other institutions currently offering programs in remote sensing will provide an evaluation of course content, presentations and laboratory exercises.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Science Education, Div.
of Science Education Resources
Improvement

5.0013, REMOTE SENSING OF FOREST RESOURCES
R.M. Hoffer, Purdue University, Agricultural Experiment Station, Dept. of Forestry & Conservation, *Executive Bldg., West Lafayette, Indiana* 47907 (0032384; IND059030)

OBJECTIVE: Analyze multispectral/multi-temporal scanner data from satellite altitudes, registered to supplemental data sets, and develop a set of computer-aided techniques that can be used in a repeatable, cost-effective manner to obtain maps and acreage estimates of forest and other natural resources features.

APPROACH: Utilize LANDSAT, SKYLAB, and other multispectral scanner data. Analyze spectral data characteristics and test several techniques for computer-aided analysis of multispectral, multi-temporal scanner data. Digitally overlay and register topographic, soils, and land ownership data onto LANDSAT scanner data. Define most effective techniques to obtain various types of map outputs requested by resource managers.

PROGRESS: Use of LANDSAT satellite data and digital computer processing techniques offers a potential for monitoring significant changes in forest cover on an annual basis. Research this past year was directed at the development of methods and computer software to relate known U.S.F.S. Forest Survey sample locations (identified by U.T.M. coordinates) to X-Y coordinates in LANDSAT data, and to develop an approach for monitoring change in forest cover using a combination of such Forest Survey and LANDSAT data. Results indicate that Forest Survey ground photo locations can be located in the LANDSAT data to within 80 meters, but additional work needs to be done to define the significance of spectral differences occuring on LANDSAT data obtained in different years. A second project involved the use of topographic data (elevation, slope, and aspect) in combination with LANDSAT data to identify and map individual forest cover types, using computer-aided analysis techniques. Several different procedures were defined, developed and applied to a set of LANDSAT data which was digitally overlaid with topographic data for a test site in the San Juan Mountains of Colorado. Preliminary results indicate that the combination of topographic and spectral data enables a significant improvement in classification accuracy, as compared to the use of spectral data above.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative
Research Office, Indiana

5.0014, MEASUREMENT OF THE THERMODYNAMICS OF THE SOMALI JET BY HIGH-RESOLUTION RADIOSONDINGS
J.M. Coleman, Louisiana State University, Agricultural & Mechanical College, Coastal Studies Inst., *University Station, Baton Rouge, Louisiana* 70803 (ATM78-13388)

The objective of this research is to study the thermodynamic structure of a rapidly moving, low level, atmospheric jet stream called the Somali jet. This jet stream of air crosses the equator over the Indian Ocean, flows north along the east coast of Africa and then northeastward across the Arabian Sea towards India where it is known as the 'southwest monsoon.' It is in part responsible for providing the thermal energy and moisture for the intense monsoon rains that fall over India and southeast Asia during the summer.

This project will consist of setting up three upper-air observing stations in Somalia to monitor the temperature, moisture and winds within the Somali jet. It will be carried out in conjunction with a related Florida State University program. The data will be analyzed with the research objective of studying the time evolution of the structure of the jet in relation to the pre- onset- and active-monsoon periods.

This project is a part of the GARP Monsoon Experiment (MONEX). MONEX is a major study to increase our knowl-

edge and understanding of the dynamics and thermodynamics of the atmosphere and ocean in monsoon regions. It is important scientifically and also has significance for global agriculture, economics and politics. The initiative for MONEX is from the Government of India with the USSR and U.S. playing major roles. In addition to the benefits mentioned above, MONEX offers an excellent opportunity for scientific and technical cooperation between, and of mutual benefit to, the U.S., India and the USSR.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0015, LOW ENERGY ELECTRONS OVER THE POLAR REGION BY USING THE USAF OPERATIONAL DMSP SATELLITES

C. Meng, Johns Hopkins University, Graduate School, *Laurel, Maryland* (DF053850; AFOSR-79-0010)

AF function - the accurate knowledge of the polar ionosphere in real time is vital to transpolar radio wave propagation. Deficiency - an effective method is required for the remote sensing of conditions in the polar ionosphere. Objective - by using data from the USAF DMSP satellites, the electron precipitation characteristics for different auroral activities and other types of low energy electron precipitation are to be identified. Contribution - after completion of this work, it should be possible to infer global distributions of detailed auroral electron precipitation based on DMSP auroral photographs.

The following studies will be made of the simultaneous auroral and electron data from a dawn-dusk orbiting DMSP-32 satellite and the new DMSP block 5D satellites, precipitation characteristics of morning oval auroras, characteristics of auroral arcs in the polar cap, precipitation characteristics over the dayside oval, especially near the cusp region. several coordinated ground-based and satellite observations are planned using DMSP-32 or 33 and the geosynchronous satellite ATS-6, NASA's polar orbiting AE-C and D satellites and the incoherent scatter radar at Chatanika in Alaska.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0016, MET AND MATH ANALYSES

A. Gerlach, Systems & Applied Sciences Corp., *6811 Kenilworth Ave., Riverdale, Maryland* 20840 (DF582220; F19628-79-C-0033)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of adequate information and techniques to satisfy military weather support requirements. Objective -(T2310G2) Determine the most appropriate numerical weather prediction model resolution for a given initial observational density. (T667007) Develop real-time radar diagnostic software for a minicomputer operated on-line with an advanced Doppler weather radar. (T667008) Develop techniques for applying digitized meteorological satellite imagery data to short range (0-6 hrs) weather forecasting. Improve the output of the AFGL/LY man computer interactive data access system (MCIDAS) to support development of techniques in satellite meteorology. (T667010) Evaluate the temporal and spatial characteristics of critical aviation weather parameters and develop descriptive display methodologies. Develop mesoscale (0-6 hr) objective weather prediction techniques for critical aviation weather parameters. How research and development contribute -provide improved weather analysis and forecasting techniques in (T2310G2) Mathematical models of atmospheric processes. (T667007) Improving the utility of advanced Doppler radar. (T667008) Improving DMSP satellite imagery and techniques for using McIDAS. (T667010) Development of real-time use of advanced weather systems and automated weather forecasts and warning techniques.

(T2310G2) Analytical and numerical techniques will be applied to problems in atmospheric dynamics. (T667007) Develop the following: software, for pattern recognition, real-time estimation of horizontal wind speed, direction, and convergence or divergence based on quantitative measurements from a single Doppler weather radar, the operational identification and prediction of damaging winds. (T667008) Acquire, navigate and archive samples of digitized satellite imagery data, correct data for various system errors and analyze in conjunction with other meteorological data. (T667010) Test and improve a prototype modular automated weather system (MAWS) using data acquired at the AFGL field facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, REMOTE SENSING APPLICATIONS TO HYDROLOGY AND WATER RESOURCES

E.T. Engman, U.S. Dept. of Agriculture, Federal Research Office, Plant Physiology Inst., Hydrograph Lab., *Bldg. 007, Room 139B, Beltsville, Maryland* 20705 (0045249; 1109-20811-003)

OBJECTIVE: Investigate the feasibility of using remote sensing (particularly microwave) for input to hydrologic models. Investigate scale relationships among point measurements and areas of various sizes.

APPROACH: Microwave data, LANDSAT and infrared data will be tested for applications as input data to hydrologic models and for direct measurement of runoff potential. Remotely sensed data from several altitudes, plus an intensive field sampling program will be used to investigate the scale of hydrologic parameters that is important in predictive models. Models will be developed to simulate the processes of remote sensing. These models will be used to generate accuracy information for various sensor-parameter problems.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Beltsville Agricultural Research Center

5.0018, GEOLOGIC MODELING OF THE PATOSPSO WATERSHED MARYLAND

H.G. Siegrist, University of Maryland, College Park Campus, Graduate School, Dept. of Geology, *College Park, Maryland* 20742 (NSG 5423)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0019, ANALYSIS OF SATELLITE SENSOR DATA

D.E. Delorey, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF275460; F19628-76-C-0190)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density and composition variations with time and space cannot be accurately predicted. Research - direct density and composition measurements with solar and geophysical parameters. How research contributes - permits development of accurate models to be used in forecasting techniques. Mathematical techniques and computer routines are developed to process satellite attitude and sensor data to calculate parameters to provide increased knowledge of atmospheric properties.

Develop and implement computer routines and techniques for the continued reduction of raw digital data from sensor outputs to vehicle attitude, sensor position vectors and associated ionospheric parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, ATMOSPHERIC DENSITY MODELS INCLUDING TIDES

J.M. Forbes, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF246720; F19628-79-C-0088)

AF function - orbital navigation, orbital surveillance. Deficiency - ephemerides of operational satellites cannot be computed accurately due to lack of knowledge of spatial and time variations of density at critical altitudes. Objective - development of improved models of the thermosphere including the effects of tides and test and evaluation of model atmospheres for use by COESA and Air Force operational organizations. How research contributes - new models, which will include work done on this contract, can be recommended for use by the NORAD Chey-

enne Mountain Space Computation Center and by COESA in the development of revised U.S. standard supplements.

A multiple linear regression (MLR) model of the thermosphere will be compared with an independent set of observations, the Jacchia (1977) empirical model and the MSIS model. A complete hybrid observational-theoretical wind model will be developed for consideration by COESA. Evaluation of the MLR model's ephemeris prediction capability will be made using data from Doppler beacon, OVI-17, OVI-21 and more recent satellites. Appropriate recommendations concerning the new models will be made to COESA and ADCOM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, MATH AND PHYSICS STUDIES

N. Grossbard, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF582640; F19628-79-C-0063)

AF function - 1. missile guidance, 2. trans-ionospheric communications, 3. infrared optical detection systems, 4. reconnaissance - target acquisition and tracking. Deficiency or opportunity - 1. lack of detailed knowledge of the gravity field contributes to missile guidance error, 2. present models of the photoelectron flux are not accurate enough to permit remote satellite monitoring, 3. lack of knowledge of the optical and infrared emissions induced by the detonation of high altitude nuclear weapons, 4. the performance of any optical system looking through the atmosphere is degraded by atmospheric light scattering. Objective - 1. determine global gravity field with maximum accuracy and precision, 2. to model approximate cross sections and to calculate the photoelectron flux, 3. to measure the spectral emissions induced in the atmosphere by electron accelerators, 4. study the intensity of solar radiation. How research contributes - 1. reduction of geodetic and gravity errors will lead to improved guidance performance, 2. the contribution of the photoelectron flux studies is to provide a more accurate specification and understanding of ionospheric properties so as to enhance the capabilities of current and future AF systems, 3. the measurement of the spectral nature of the atmospheric emissions induced by nuclear weapons will improve the infrared optical detection systems, 4. achieving the objective of this study will lead to an improved capability to predict the effects of the atmosphere on EO systems.

Mathematical studies and numerical algorithms will be applied to properly analyze and test the models related to the above systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, HIGH-ALTITUDE CHARGE TRANSPORT

M. Kanal, Clark University, Graduate School, *950 Main St., Worcester, Massachusetts* 01610 (DF582520; F19628-79-C-0008)

AF function - satellite communication, navigation, command and control. Deficiency - inadequate knowledge of high-altitude transport and heating mechanisms for the proper interpretation of data from AF satellites. Objective - to calculate the effects of high-altitude electron-ambient plasma coulomb interactions and the pitch-angle scattering of electrons in the plasmasphere on electron transport in the upper atmosphere. Results will be compared with current AF satellite data. How research contributes - provides information essential to microwave and radio frequency transmission through the upper ionosphere. Provides data essential for design and utilization of communication guidance and surveillance systems. Provides understanding of upper ionosphere transport mechanisms which affect the neutral upper atmosphere.

Solve the Boltzmann equation for high-altitude (above 500 km) conditions, emphasizing the plasmasphere and taking into account the effects of coulomb interactions and pitch-angle scattering. From this solution calculate the heat flow vector and compare the predicted electron temperatures with those obtained from AF satellites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, PHASE AND AMPLITUDE SCINTILLATION MODELLING AT EQUATORIAL AND HIGH LATITUDES

S. Basu, Emmanuel College, Graduate School, *400 the Fenway, Boston, Massachusetts* 02115 (NSG 5419)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0024, RESEARCH DIRECTED TOWARD DESIGN FABRICATION TEST AND LAUNCH SERVICES FOR SCIENTIFIC ROCKET PAYLOADS

L.J. O'Connor, Northeastern University, School of Engineering, Dept. of Electrical Engineering, *360 Huntington Ave., Boston, Massachusetts* 02115 (DF248250; F19628-76-C-0152)

AF function - missile detection, surveillance, reconnaissance and communications systems. Deficiency - plume radiation characteristics of low thrust rocket engines operated at high altitude. Effects on LF/VLF wave propagation during periods of abnormal ionization in the lower atmosphere. Objective - design of multi spectral measurement payloads to determine the radiant intensity, spatial radiance distribution, and infrared and ultraviolet spectra of low thrust rocket engines operated at high altitudes. Design of small sounding rocket payloads for ion and neutral mass spectrometer measurements, IR interferometer measurements and solid rocket motor post burnout characteristics. How research contributes - the payloads developed under this contract will enable AFGL scientist to make IR and UV measurements of small rocket engines at high altitude - to make measurements of positive and negative ions and charged particles - measure the density of thermoapheric species in support of a calibration of the DMSP-SSD package - determine the magnitude of the post burnout thrust and outgassing of solid rocket motors.

Under line item 0001, the contractor will conduct engineering liaison with AFGL scientists and engineers in order to define technical requirements, design, fabricate or refurbish, test and provide launch services for six (6) multi spectral measurement program payloads. The contractor will be responsible for the design, fabrication and test of the payload in-flight power system - programmers for all onboard logic functions - payload aspect and attitude measurements - all instrument support structures - interconnecting wiring - nose cone and aerodynamic fairings - nose cone ejection and fairing opening system necessary to expose scientific instruments or support equipment in their measuring regime during exoatmospheric flight. The contractor will be responsible for design, fabrication and operation of all GSE necessary for assembly, test and launch support of the payloads at the contractor plant, AFGL, and test facility and the eventual launch site. Under line item 0002, the contractor will conduct engineering liaison with AFGL scientists and engineers in order to define technical requirements, design, fabricate, or refurbish, test and provide launch services for up to fifteen (15) scientific sounding rocket payloads. These payloads will be flown in support of various AFGL IHWU. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, STUDY OF MAGNETIC STORM PARTICLES ENERGIZATION

B.F. Sellers, Panametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DF582030; F19628-79-C-0009)

AF function - communications, surveillance and navigation. Deficiency - Air Force space systems are subject to constant irradiation damage and ground-based systems are affected by ionizing particles incident on the ionosphere. The way by which trapped and precipitating particles acquire damaging energy is not known in sufficient detail to model and predict resultant disturbances. Objective - to solve various magnetospheric problems related to charged particle motion for trapped and precipitating particles. How research contributes - increased capability for modeling magnetospheric events will provide inputs for improved disturbance predictions and for assessing radiation hardening requirements.

High resolution electrostatic analyzer data from Air Force rocket and satellites will be used as inputs for the study of inverted V events, describing the average electron environment

and for the study of particle energy deposition in the atmosphere as related to acceleration mechanisms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, SATELLITE RADIATION DOSIMETER

Unknown, Panametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DF581660; F19628-78-C-0247)

AF function - navigation, communications and surveillance. Deficiency - inaccurate environmental specification for radiation hardness of microelectronic components will result in inefficient design criteria for military satellite systems. Objective - acquire a high energy (1-10 meV) electron radiation dosimeter for satellite measurements. How research contributes - direct measurement of the radiation dosage due to the high energy electron spectrum is needed to resolve uncertainties in calculations of radiation hardening requirements.

A radiation dosimeter will be designed, fabricated and launched aboard a satellite to measure the specific radiation encountered by a specific target due primarily, to electrons (1-10 meV).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, FILM ANALYSIS

I. Kofsky, Photometrics Inc., *Lexington, Massachusetts* 02173 (DF583700; F19628-79-M-0010)

AF function - surveillance and communication satellites. Deficiency - electrical charging of satellites causes failures of on-board electronic components. Objective - analysis of film used on a sounding rocket payload to record arcing and discharge phenomena due to vehicle charging. How research contributes - by determining the volume emission in the sheath during vehicle charging, information will be obtained as to the mechanism of vehicle neutralization. This information will be used to develop instrumentation to control and reduce satellite spacecraft charging.

Photographic film records obtained during the flight of Astrobee F rocket No. A31.603 will be reduced by microdensitometer procedures and analyzed to determine volume emission rates in the payload sheath during the rocket flight. Theoretical volume emission rates will be calculated assuming various scenarios of return currents and will be compared to the measured values.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, REACTIONS OF EXCITED ATMOSPHERIC GASES SPECTRAL DATA

I.L. Kofsky, Photometrics Inc., *Lexington, Massachusetts* 02173 (DF583280; F19628-79-C-0073)

Air Force function - communications, surveillance, detection, tracking. Deficiency - predictive capability for electron concentrations and other atmospheric parameters following atmospheric nuclear bursts. Objective - identification of the visible and ultraviolet spectral data requirements most needed for digital computer codes used to predict atmospheric nuclear effects. How research contributes - this study will allow the in-house program to concentrate its limited resources on the most important inputs for codes such as OPTIR, ROSCOE, HARC, PHARO, etc.

Problem areas in systems codes will be identified and correlated with deficiencies in the spectral data used as inputs to the codes. The sensitivity of the effects to possible uncertainties in the inputs will be considered. Particular attention will be given to defense systems codes in the areas of satellite communications, electronic and optical surveillance, and tactical military operations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, INSTRUMENTATION ANALYSIS DESIGN AND FABRICATION OF SYSTEMS FOR AIR FORCE PROGRAMS

A.H. Howell, Tufts University, Medford Campus, School of Engineering, Dept. of Electrical Engineering, *Medford, Massachusetts* 02155 (DF248700; F19628-77-C-0047)

AF function - scientific balloon systems and associated instrumentation. Deficiency or opportunity - exploit the performance capabilities of free and tethered balloons by designing systems for highly specialized scientific payloads or for unusual flight performance requirements. Objective - to provide expert analysis and design, and limited fabrication of instrumentation and balloon system component for special applications. How research contributes - appropriately designed, instrumented balloon systems provide efficient and often uniquely useful high altitude and tethered platforms for emergency communications, surveillance and optical observations.

Balloon/payload configurations such as the balloon altitude mosaic system (BAMM), the air launched balloon system (ALBS) and the LORAN C balloon-borne antenna system will be analyzed and component design changes initiated if needed to ensure optimum balloon/payload performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, DEVELOP ION MASS SPECTROMETER TO MEASURE D-REGION CLUSTER IONS FOR LF/VLF COMMUNICATIONS

A.D. Bailey, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581100)

AF function - communications, detection, track and intercept, nuclear weapons delivery. Deficiency - inability to forecast atmospheric interactions affecting the design and operation of military LF/VLF and other systems such as over-the-horizon radar, polar communications, reentry vehicles and satellite ephemerides. Objective - develop and test instrumentation to accurately measure positive and negative ion composition and densities in the D and E regions, especially between 40 and 90 km for calculations of LF/VLF transmissions. How research contributes - provides instruments for, and conducts experiments measuring the composition and densities of ion species important to AF systems operations. The mass distribution of large positive and negative ion clusters between 40 and 90 km is not well known. This effort will attempt to determine the ion composition and physical-chemical processes which degrade LF/VLF communications and otherwise affect AF EM systems operations.

A new instrument will be designed to overcome difficulties previously encountered in attempts to measure heavy ions in the 40 to 90 km region. Rocket-borne measurements with this instrumentation are planned to measure mid-latitude diurnal variations. Measurements are planned for eclipse or twilight measurements of photo-detachment and electron attachment processes. Such basic measurements should establish the capability to assess cluster concentrations in future programs during polar disturbances.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, SPACE VEHICLE CHARGE EJECTION STUDIES

H.A. Cohen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583620)

AF function - communications, satellite survivability and surveillance. Deficiency - inadequate knowledge of the effects of charged particle ejection systems on space vehicles in the upper atmosphere. Objective - to study and determine Air Force applications of rocket- and satellite-borne charged particle ejection systems. How research contributes - the research will determine both the advantages and disadvantages of Air Force applications of charged particle ejection systems on space vehicles.

A sounding rocket payload will be designed, built, tested, and flown to achieve the objectives of measuring spacecraft

charging during beam ejection, determining limitations of using unneutralized beams, and investigating techniques and problems of high energy charged particle ejection and beam-ambient plasma interactions. Charged particle ejection sources will be used to eject charged particles both positive and negative with a wide dynamic range of current, mass, energy and injection period. For the purpose of investigating spacecraft charging during the rocket payload flight measurements will be made of beam characteristics, vehicle charging, the shape and structure of sheaths, and changes in return current characteristics. Measurements will also be made of the important ambient and vehicle parameters such as ion and electron density and temperature before and during charge ejection, the neutral density and characteristics of the ambient near the vehicle, and vehicle pitch and aspect angles. The data will also be compared to theory for validation and extension of models used to explain and predict beam ejection effects on space vehicles and the atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, BALLOON MEASUREMENTS OF SOLAR ULTRAVIOLET RADIATION IN THE STRATOSPHERE

L.A. Hall, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF244820)

AF function - environmental impact of high-altitude vehicles. deficiency - effect of aircraft effluents on solar UV absorption and on ozone. Objective - to determine solar, ultraviolet energy deposition rates and ozone concentrations. How research contributes - energy deposition rates and ozone concentrations will improve models used in computation of environmental impact of Air Force vehicles.

Balloon flights of a solar spectrometer will provide data on the solar spectrum in the range 2000-3000 A, as a function of height in the stratosphere. From these data, energy deposition rates and ozone concentrations will be computed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, ELECTRON FLUX AND OPTICAL EMISSION STUDIES

J.R. Jasperse, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583190)

AF function - trans-ionospheric ranging and communications, remote ionospheric monitoring. Deficiency - present state-of-the-art in relating natural optical emissions to the electron density profile is not understood well enough to permit remote satellite monitoring of the auroral oval and mid-latitude ionosphere. Objective - to develop knowledge in relating optical emissions to electron density profiles. How research contributes - in the short-term, to assist AWS and SAMSO in their ionospheric modelling and monitoring effort by supplying computer codes for calculating the electron flux and electron density profiles. In the long term, to provide a more accurate specification and understanding of ionospheric properties so as to enhance the capabilities of current and future AF systems.

Optical emissions in the auroral oval and at mid-latitudes will be surveyed. Satellite measurements of the incoming electron flux in the oval will be studied. Preliminary calculations will be made which relate these fluxes and emissions to the electron density profile. Computer codes will be developed to perform detailed calculations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0034, AURORAL SCINTILLATION MODELLING STUDIES

J.P. Mullen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580910)

AF function - communications/navigation. Deficiency - signal fading, range errors. Objective - to model ionospheric parameters and predict deficiencies. How research contributes - develops and tests predictive models of ionospheric scintillation based on actual data to be used by AWS. Model will include effects of elevation and frequency scaling.

Using actual data from Goose Bay and Narssaq Point, models will be constructed using geophysical parameters to predict scintillation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0035, HEAO-C THEORETICAL STUDIES

D.F. Smart, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580750)

AF function - communications and detection. Opportunity - geomagnetic field models are used to predict effects important to a number of USAF communication and detection systems. The HEAO-C satellite (to be launched in 1980) will provide a unique, hitherto unavailable opportunity to check the absolute accuracy of mathematical models of the magnetic field in the magnetosphere by comparing the calculated effects of the magnetic field on energetic charged particles with the forthcoming experimental measurements. Objective - to perform theoretical studies of the energetic charged particle access through the inner magnetosphere where the internal geomagnetic field dominates. These studies are to be conducted within the framework of the expected observations to be available from the HEAO-C satellites. How research contributes - the results to be obtained are the calculations that must be made prior to satellite launch in order to have the theoretical predictions that can be compared with the satellite measurements to be obtained.

There are specific detailed characteristics of energetic charged particle access to the geomagnetic field that have been theoretically predicted but have never been experimentally measured because the experimental resolution has not been adequate. The planned observations from the HEAO-C satellite are expected to have sufficient detail in resolution to measure these effects. The primary technical 'tool' to be utilized in this research effort is the high speed digital computer. In this effort, numerical calculations of energetic charged particle access into the domain controlled by the geomagnetic field will be made for selected positions for the HEAO-C satellite orbit as defined by geographic latitude, geographic longitude, and altitude. Utilizing a current model of the quiescent geomagnetic field, such as the International Geomagnetic Reference Field, numerical results for a sufficient number of directions and locations for a satisfactory description of the structure expected in the access of energetic charged particles to the satellite are to be derived. The numerical results are to be completed before the satellite is launched in 1980.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0036, LOWER IONOSPHERE EM DISTURBANCES

W. Swider, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582810)

AF function - VLF/HF/VHF communications/radar. Deficiency -inability to determine effects of nuclear scenarios and natural disturbances on communications/radar such as VLF (AABNCP), HF (SAC-ROC5-72) (MAC-GOR 3-72), OTH-B (TN-ESD-RADC-0401-71-01). Objective - to measure ionospheric D- and E-region parameters during a solar proton event (SPE) in order to develop predictive software for communication/radar systems in natural solar disturbances and general nuclear conditions. How research contributes - payoff is through better predictability of ionospheric disturbances on VLF-HF communications/ radar systems. This will assist both operational and design requirements.

Rocket payloads containing positive and negative ion mass spectrometers, Gerdien condensers, and energetic charged particle detectors will be launched during an SPE, especially around sunrise and sunset periods. Supporting ground-based and satellite observations of opportunity will be incorporated into the program. In this manner, essential parameters will be determined to develop detailed physical-chemical predictive codes describing ionospheric conditions which can be used to determine the effects of ionospheric disturbances of natural/nuclear origin on electro-magnetic propagation. Concurrently, labora-

tory work on significant related chemical processes also will be undertaken.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0037, MISSILE CEP IMPROVEMENT FROM IMPROVED GRAVITY MODELS

B. Szabo, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582900)

AF function - strategic weapons delivery. Deficiency - current gravity models are inadequate to satisfy CEP goals of advanced ICBM's in the mid 1980's. Objective - determination of the impact errors of advanced long range ICBM's by utilizing improved regional and global gravity models. How research contributes - determines expected ICBM impact errors due to various gravity models.

Gravity models (launch region and global) derived by new combination technique and from new gravity data (such as satellite altimetry) will be used for the determination of the omission and commission errors of the global model. This error will be combined with the launch region gravity model, GM, and launch site gravity errors for the total gravity dependent error of an advanced ICBM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0038, SUNSPOT-FLARE ASSOCIATION

F.W. Ward, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580830)

The determination of the latitudinal and longitudinal motions of sunspot groups and their systematic variations over the course of the cycle of their development. In particular, this study will uncover the systematic differences between the active and inactive portions of the cycle, and any implications related to spot development.

The analysis will consist of the stratification of the data on the occurrence and two-dimensional motions of spot groups from a long and homogeneous record. This stratification will determine the rates of motion as a function of latitude, and the variation of these motions as the focus of activity moves to progressively lower latitudes during the cycle. An attempt will be made to determine the rate at which the underlying physical processes shift with latitude.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0039, SPECTRAL INTERFEROMETER SWIR DAYLIGHT BACKGROUND

N.B. Wheeler, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583080)

AF function - this work supports the Air Force functions of detection, surveillance, tracking and early warning. Deficiency -present operational and future satellite infrared surveillance systems at short and middle infrared wavelengths are limited by the background clutter from enhanced atmospheric emissions from disturbed atmospheres both natural, such as aurora, and nuclear. Improvements in such systems will depend on proper selection of spectral filters. Objective - to obtain high resolution short and middle infrared spectra of atmospheric emissions associated with natural and disturbed daylite backgrounds. How research contributes - spectral properties of the daylit auroral and natural backgounds will be measured from 1.5 to 7.5 microns and categorized. The results will be presented to Air Force programs offices as appropriate and utilized in predictive infrared nuclear code development and in system design.

A rocket-borne field widened interferometer has been developed. It is capable of obtaining excellent spectra at 2/cm resolution. It has become feasible to make high resolution sensitive measurements of atmospheric emitters in the natural and disturbed daylit atmosphere. One rocket-borne instrument will be launched at White Sands, New Mexico for undisturbed mid-latitude backgrounds. Another rocket-borne instrument will be launched at Poker Flat, Alaska into a daylit auroral event. The spectra so obtained with these flights will be an important tool in understanding the chemistry of these emitters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0040, THE OPAQUE MINERAL CHEMISTRY OF ALLENDE, BASALTIC ACHONDRITES, AND THE ANTARCTIC METEORITE SUITE

S.E. Haggerty, University of Massachusetts, Amherst Campus, School of Natural Sciences & Mathematics, Dept. of Geology, *Amherst, Massachusetts* 01002 (NSG 7549)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0041, USE OF REMOTE SENSING FOR LAND USE POLICY FORMULATION

R.D. Vlasin, Michigan State University, Agricultural Experiment Station, Dept. of Resource Development, *New Administration Bldg., East Lansing, Michigan* 48823 (0064769; MICL01168)

OBJECTIVE: To demonstrate the operational ability and uses of remote sensing for land use planning and policy formulation. Specifically to: develop, apply, and evaluate a system which will incorporate remote sensing for classifying land use and resource characteristics; apply remote sensing to program needs of selected Michigan agencies; apply the findings of the research to the land use policy formulation process in Michigan.

APPROACH: Actual sites selected with governmental units to test usefulness of various RS applications. 'Short-term' direct agency applications to permit development, completion, evaluation, and approaches. Applications also to longer-run policy efforts. Departments of Crop & Soil Sciences, Forestry, Resource Development, Urban Planning & Landscape Architecture, and Geography are involved.

PROGRESS: During 1978, remote sensing techniques were used to derive data required for effective land/resource use decisions by agencies in Michigan. Photo-derived information on open water and marshes, forested wetlands, and residential areas in Saginaw and Bay counties is being used by field teams in mosquito treatment operations. A vegetation inventory of the Shiawassee National Wildlife Refuge was prepared. A procedure was developed to identify 'wild areas' using LANDSAT and aerial imagery. The Michigan Department of Natural Resources will use information provided for six counties to select sites for dedication as natural preserves. LANDSAT imagery, supplemented by NASA PB-57 and other aerial photography, is being used to determine the location, extent, and biomass of non-commercial timber resources in west central Michigan. The information will be used by private firms in planning for two wood-chip burning electric power generating plants. Temporal aerial photos are being used to assess the environmental (particularly drainage alteration) impacts of existing gas and oil pipelines crossings of streams and wetlands. The study is aimed at identifying better pipeline construction methods which prevent or mitigate impacts on sensitive environments. Project personnel have developed a sand dune morphology classification for the shore zone of Michigan and procedures for inventory and monitoring of sand dune mining operations using aerial imagery.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Michigan

5.0042, THE INTERACTION OF A SPACECRAFT WITH ITS ENVIRONMENTAL SPACE PLASMA

U. Samir, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (ATM76-19790 A01)

This grant funds studies of the interaction of a spacecraft with the plasma environment, with the emphasis on the wake region behind the spacecraft. This is an important research areas which has received considerable theoretical attention, but where little effort has gone into experimental testing or verification of the theoretical ideas. There is increased interest in this subject at present because of proposals to use a wake shield with the shuttle spacecraft to produce an ultra-high vacuum. It may be that

the electrical wake will be the limiting factor on the particle density in the region behind the wake shield.

Specifically, research under this grant will pursue two points: 1) Analysis of in situ observations (from the AE-C/E satellites) in order to perform a phenomenological, parametric investigation, focusing on interaction dependences upon spacecraft velocity, diameter, and potential (measured in units of the ambient plasma parameters. 2) Comparisons between theory and experiment as well as between different theoretical models. Such studies should enhance our physical understanding regarding the nature and range of applicability of the assumptions (physical and mathematical) used in various wake/sheath theories.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0043, TROPOPAUSE CLIMATOLOGY
Unknown, Control Data Corp., *8100 34th Ave. S., Minneapolis, Minnesota* 55420 (DF583570; F19628-79-C-0098)

AF function - environmental impact assessments and laser propagation. Deficiency - current meteorological definition of tropopause height is frequently misleading regarding mid-latitude division between stratosphere air mass and troposphere air mass. This leads to a poor assessment of the stratosphere-troposphere interchange and the rate of removal of stratospheric pollutants. Objective - it is the objective of effort to review existing historical records and derive a more appropriate definition of the tropopause and to then determine the seasonal and latitudinal variations of the mass exchange across the tropopause. How research contributes - the planned measurements will lead to a new description of aerosol distribution in the lower atmosphere. This data will be used in environmental assessments and in computer models predicting optical propagation.

Analyze on a global basis a minimum of ten years of ozonesonde and radiosonde records to evaluate possible definitions of tropopause from the viewpoint of stratosphere-troposphere mass exchange. Apply the appropriate definition to the ten year set of data to determine suitable climatology. Tables and charts are to be prepared presenting monthly means and frequency distributions as a function of year, latitude and longitude. Estimates of the stratosphere-troposphere exchange are to be determined from seasonal adjustments in the turbopause altitude.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0044, FORMATION OF ATMOSPHERIC AEROSOLS
K.T. Whitby, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Mechanical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (R803851-03S4; G603A-AA-019)

Aerosol size distributions have been measured in the St. Louis area as part of EPA's Project MISTT using aircraft and ground-based self-contained mobile laboratories. The University of Minnesota's portion of the project included aerosol measurements aboard an aircraft and the operation of a mobile van on the ground under the plumes.

The past year was devoted primarily to data analysis, the development of new analysis techniques and reporting results of aerosols data obtained over the past several years in Project MISTT and the Roadway Aerosol Study.

During the coming year the Particle Technology Laboratory of the University of Minnesota will be measuring aerosol size distribution for EPA's Project STATE (Sulfur Transport and Transformation in the Environment) in Tennessee and for EPA's Project SCRUB in Alabama and Minnesota. The STATE Program is directed to describing reactions and atmospheric processes affecting plume behavior over time scales of 12-96 hours and distances out to 1000 km. By contrast the SCRUB program will provide an assessment of the transport and transformation occurring within a power plant plume with an SO2 scrubber out to distances of about 1000 km and travel times mostly less than 12 hours.

Resources will be provided to complete data analysis and report on Project MISTT and to participate in the planning of Project SCRUB and the subsequent data analysis. Other tasks include the measurement of gaseous and aerosol pollutants under and in plumes being characterized in Project STATE and development of an aerosol mobility chromatograph to determine molecular composition of sulfur-containing aerosols.

SUPPORTED BY U.S. Environmental Protection Agency,
Office of Research & Development,
Environmental Sciences Research Lab.

5.0045, TORNADO MEASUREMENTS
S.A. Colgate, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (ATM76-82562)

The objective of this research is the testing of small instrumented rockets fired from a slow-flying aircraft to make measurements in water spouts, and, potentially, tornadoes. The rockets will measure pressure, temperature, magnetic field ionization and electric field with 2.5 meter spatial resolution. The capabilities have already been demonstrated of firing small rockets of 350 grams mass, speed Mach 1.5, accuracy plus or minus .02 radians with adequate receiver telemetry signals strength at 6 kilometers from a slow-flight STOL-equipped Cessna 210 G. Initially, an extensive calibration and flight-testing will be performed in Florida using water spouts as targets. If these are successful, an attempt will be made to investigate tornado targets with the aircraft operation in Oklahoma, Texas and Kansas.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0046, INVESTIGATION OF PLANETARY-SCALE FLUCTUATIONS OF THE ATMOSPHERE
R.J. Deland, New York University, Washington Square & University College of Arts & Sciences, Dept. of Applied Science, *421 1st Ave., New York, New York* 10012 (ATM77-07094 A01)

The structure and dynamics of planetary-scale fluctuations of the atmosphere are the basic objectives of this research. The analysis is based on global observations of isobaric geopotential and temperature, augmented by satellite measurements of the thermal radiance in narrow spectral bands, from which atmospheric temperature is deduced by regression relations between radiances and temperatures.

The work has two main objectives: deduction from statistical results of models of the atmosphere's planetary-scale behavior that satisfy the physical constraints, and estimation of upward energy transport associated with the fluctuating planetary-scale waves and variations of the zonal wind.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0047, ATMOSPHERIC ELECTRICITY
B. Vonnegut, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Atmospheric Science, *1400 Washington Ave., Albany, New York* 12222 (ATM76-00908 A02)

The scientific objectives of this project are more specific than previously mentioned but fall within the same four topics. They are: (1) Initiation cirriform clouds by seeding ice supersaturated air with silver iodide. (2) Study of rainfall structures with various synoptic conditions. (3) Interpretation of satellite data for lightning detection. (4) Quantitative information concerning the extraordinary electrical activity during tornado events.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0048, MULTISPECTRAL PHOTOGRAPHIC REMOTE SENSING SYSTEM TO EXPEDITE DETECTION OF TREE STRESS IN URBAN ENVIRONMENT

T.M. Lillisand, State University of New York, College of Environmental Science & Forestry, Graduate School, McIntire Stennis Program, *Syracuse, New York* 13210 (0066320; NYZ-113-0-003)

OBJECTIVE: Quantify changes in the photometric and geometric properties of selected species in response to stress mechanisms typical of urban environments; develop and test a photographic remote sensing data acquisition and analysis system which would permit expeditious detection of stress for the species/stress mechanisms studied above; delineate mechanisms by which the above detection system might be integrated into the urban tree cover inventory and maintenance process on a regional basis.

APPROACH: Laboratory investigation of the photometric and geometric response of trees to controlled sources of stress will be used to design an aerial photographic stress detection system. Photographic effects (film processing, atmospheric attenuation, etc.) precluding remote stress detection will be negated through sensitometric film control and analysis. Close range photogrammetry, laboratory spectroradiometry, multispectral aerial photography and semi-automated electronic image analysis will be employed.

PROGRESS: An Experimental Photographic Interpretation Console (EPIC) was used to detect nutrient deficiency and pathogen induced disease by spectral ratioing of color film records acquired under field conditions.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, New York

5.0049, SATELLITE ACCELEROMETER FIELD SUPPORT

W. Lange, Textron Inc., *P.O. Box 1, Buffalo, New York* 14205 (DF249770; F19628-77-C-0121)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be accurately predicted. Objective - provide field services associated with the launch of atmospheric density triaxial accelerometer systems. How research contributes - permits development of accurate density forecasting techniques.

The new SETA triaxial accelerometer will be flown on three Air Force satellites. The new ROCA accelerometer will be flown on an Air Force satellite. Pre-launch integration and testing will be supported to verify that installation and checkout procedures are as required and that instrument operation is normal. The second and third NAVPAC units will require additional vibration testing and subsequent recalibration. These procedures will ensure that all instruments are properly integrated and operating prior to launch.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0050, 3-D SCATHA MODEL VALIDATION

J. Roche, U.S. National Aeronautics & Space Admin., Lewis Research Center, *21000 Brookpark Rd., Cleveland, Ohio* 44135 (DF583470)

AF function - communications, surveillance and navigation. Deficiency - anomalous behavior of high-altitude satellites due to spacecraft charging. Objective - a 3-D SCATHA satellite computer model will be constructed and validated. How research contributes - the SCATHA sheath model is required for the interpretation of SCATHA data. The SCATHA model is a general code which can model any existing or proposed spacecraft for the purpose of the spacecraft charging analysis, and for the analysis of contamination and active control.

A finite element computer model of the SCATHA satellite is set up. Potentials on the satellite surface and in the surrounding space are set up. Photosheaths, secondary emission and plasma shielding as well as solar shadowing are accounted for. Particle trajectories from ion and electron guns are computed, as well as the response of particle detectors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0051, INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF REMOTELY SENSED DATA

G.W. Petersen, Pennsylvania State University, University Park Campus, Agricultural Experiment Station, Dept. of Agronomy, *201 Shields Bldg., University Park, Pennsylvania* 16802 (0071504; PEN02289)

OBJECTIVE: Develop techniques for the processing, interpretation and analysis of remotely sensed data collected by aircraft and spacecraft.

APPROACH: Remotely sensed data collected by aircraft and satellite will be interpreted by a multidisciplinary team. Imagery and digital data will be analyzed using conventional airphoto interpretation techniques as well as automatic data processing techniques. Emphasis will be placed on the following areas: Soil mapping, forest inventory, strip mining, land use, crop yield predictions and geology. Multi-spectral and multidate data will be used.

PROGRESS: The Office for Remote Sensing of Earth Resources (ORSER), a center within the Institute for Research on Land and Water Resources at The Pennsylvania State University, is an interdisciplinary group established in 1970 for the purpose of participating in projects involving the use of remotely sensed data of earth resources. Investigators involved in ORSER research projects have been from the fields of agronomy, civil engineering, computer science, electrical engineering, forestry, geology, geophysics, hydrology, plant pathology, pattern recognition, regional planning, and soils. A problems-oriented, rather than a discipline-oriented, approach is taken in the completion of tasks, in order that associates from various disciplines may work together toward a common goal. ORSER has directed most of its efforts toward processing, analysis, and interpretation of multispectral remotely-sensed data, most of which have been supplied by NASA in both imagery and digital format. Photointerpretation has been a vital part of the overall analytical process, but the emphasis has been on the use of digital computer algorithms for data processing. The end product of a project is typically a computer map showing various environmental and land use characteristics of data points in the analyzed scenes. NER, D. A., LOBAUGH, B., MUELLER, W. J. 1978. Effect of calcitonin on acid-base balance and blood calcium of chickens. IN: D. H. Copp and R. V. Talmage (eds.). Endocrinology of Calcium Metabolism. Excerpta Medica, p. 384.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Pennsylvania

5.0052, THE NONLINEAR DYNAMICS AND MOIST CONVECTION AND ITS EFFECT ON EXTRATROPICAL CIRCULATION SYSTEMS

J.A. Dutton, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (ATM78-02699)

The overall objective of this research is to improve the understanding of the feedback mechanisms between mesoscale precipitation systems and the larger scale extratropical circulations.

Specifically, the goals are: (1) verification of mesoscale forecast model, (2) testing, verification, and improvement of parameterization schemes for cumulus convection, (3) development of improved initialization schemes that can utilize subsynoptic scale data, such as satellite, radar, or surface weather observation in a way to improve short-range forecasting.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0053, ANALYSIS OF BOUNDARY LAYER WIND PROFILES

H.A. Panofsky, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (ATM78-01009)

Three kinds of investigations will be made at the new Boulder Atmospheric Observatory. First, to calibrate the site, that is, to use wind profiles to infer the distribution of roughness length

with wind direction and season. Second, Monin-Obukhov wind profile theory will be applied to the mean winds measured at the 300-meter tower. Surface stresses obtained from the theory will be compared with direct measurements as a check. An attempt will be made to find the limits to which the theory is applicable. Further, simple techniques will be developed for estimation of winds at 100 meters and above from wind near the surface, and from simple estimates of stability and roughness. Third, the variances and spectra of the horizontal wind components will be related to easily available predictors, such as wind speed, roughness length, height of mixed layer and various measures of stability.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0054, REMOTE SENSING OF ATMOSPHERIC PROPERTIES/OCEAN UPPER LAYER TEMPERATURE
K.J. Petri, U.S. Dept. of Defense, Navy, Naval Air Development Center, Sensors & Avionics Tech Directorate, *Warminster, Pennsylvania* 18974 (DN081135)

To investigate the feasibility of utilizing a shipborne lidar to remotely measure atomspheric properties which impact the performance of radio/optical frequency systems, and an airborne lidar to remotely measure subsurface ocean temperature profiles.

Shipborne lidar techniques will be tested and evaluated to determine the optimum method of remotely measuring the radio refractive index and electrooptical properties of the atmosphere. Airborne pulsed blue-green Raman lidar techniques will be evaluated to determine the depth/accuracy limits of remote temerature measurement predictive models.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Tech Admin.

5.0055, DEVELOPMENT OF A SOIL MOISTURE PROFILE MODEL FOR USE WITH REMOTE SENSORS
B.J. Blanchard, Texas A & M University, College Station Campus, School of Engineering, Dept. of Agricultural Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (ENG77-28343)

This research project is for the investigation of remote sensing by microwave equipment as a means of mapping variations in soil moisture that occur naturally. The objectives of this study are to: (1) define the relation between time series measurement of moisture in two dynamic depths of near surface soil for both evaporation and infiltration; (2) define the deviations in the above relations due to differences in physical characteristics of the soil and the soil profile; and (3) develop and test a soil profile model that requires only remote sensing input for use in areas where detailed climatic data are not available.

It is expected that the results of this research project will help to realize the potential of remote sensing techniques for estimating flood potential on ungauged watersheds.

This is the first year of a 2 year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

5.0056, DISTURBED ATMOSPHERIC RADIATION MEASUREMENTS
D. Burt, Utah Higher Education System, Utah State University, Graduate School, *Main Bldg., Room 132, Logan, Utah* 84321 (DF582410; F19628-79-C-0080)

AF function - surveillance and detection, and support of USAF nuclear weapons effects development programs. Deficiency - spatial and time-varying infrared backgrounds interfere with target detection, tracking and identifications. Ionization of the atmosphere interferes with radio wave propagation. A lack of knowledge of the infrared properties and ionization of the upper atmosphere limits our ability to evaluate the effects of nuclear detonations on the aerospace environment. Therefore, these properties must be measured and understood. Research - measurements of infrared atmospheric emissions and of atmospheric ionization under both disturbed (auroral) and undisturbed conditions, utilizing rocket, satellite, balloon and aircraft platforms, supported by both ground based in situ measurements, laboratory experiments and investigative studies. How research contributes - measurements of atmospheric ionization and infrared emissions provides information about atmospheric molecular composition as well as the spatial and temporal variations. The results of this research are necessary for determining the characteristics of the infrared background, for predicting the infrared radiation from natural (air glow and auroral) sources as well as disturbed (nuclear or otherwise) backgrounds, and for predicting radio wave propagation in a disturbed atmosphere. These results are directly applicable to the design and operation of surveillance and detection systems and communications systems utilizing radio wave propagation.

To provide for the conducting of field measurements utilizing sounding rocket, satellite, aircraft, and balloon platforms, and to provide for the development of new instrumentation and measurement techniques and laboratory simulation studies. This effort is to include: a. Design, fabrication, testing and engineering calibration of instrumentation, including infrared field-widened interferometer, particle counters, photometers, radiometers, mass spectrometers and langmuir probes; b. Design, fabrication and integration of multi-sounding rocket payloads and field support; c. Development of high power electron accelerators, for stimulating the atmosphere and design of instrumented payloads to carry these accelerators; d. Development of advanced techniques for rocketborne probes of the atmosphere; e. Reduction and analysis of flight measurements data, and studies of these results to determine possible directions of future measurements programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0057, NEAR-INFRARED SPECTROMETRIC AIRGLOW MEASUREMENTS DURING THE TOTAL SOLAR ECLIPSE OF 26 FEB 1979
W.R. Pendleton, Utah Higher Education System, Utah State University, School of Science, Dept. of Physics, *Main Bldg., Office 104, Logan, Utah* 84321 (DF054340; AFOSR-79-0040)

AF function - advanced space-borne surveillance systems and modelling in support of ionospheric dependent communications and radar systems require detailed knowledge of the energetic chemistry and IR emission of atmospheric species under natural and nuclear conditions. Opportunity - scattered sunlight makes it impossible to measure the IR dayglow to test our knowledge/models of the excitation/emission of atmospheric molecules. The eclipse of 26 Feb 79, the last over N.A. this century, and recent instrument development provide a unique opportunity to acquire first-ever moderate resolution (both spectral and temporal) near IR spectra of the residual dayglow. Objective - to measure the time dependent near IR emissions of OH and O2, at 10 sec/spectrum temporal and 3 per cm spectral resolution to test excitation and relaxation chemistry models. How work contributes - the data will permit testing of the photochemical models of the mesosphere and, due to the capability of measuring the relaxation emissions, models of nuclear effects.

D-based dayglow measurements in the .8-1.7 and 1.5 to 2.3 micron regions will be acquired from a site in N. Canada near the centerline of the eclipse. Comparisons with NASA, AFGL and NRC rocket measurements will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0058, IMPROVED ANALYSIS METHODS FOR ATMOSPHERIC EXPERIMENTS
J. Simpson, University of Virginia, School of Arts & Sciences, Dept. of Environmental Science, *Garrett Hall, Charlottesville, Virginia* 22903 (ATM78-10087)

This research develops statistical and physical tools to advance the ability to detect changes in one or more related variables in atmospheric experiments. The technique development is based primarily on the physical and statistical data from the Florida Area Cumulus Experiment (FACE) in which the investigators were participants.

One objective of the research is to examine the validity and physical reasons for a few cases providing most of the cloud

seeding effect in FACE. Intensive meteorological case studies are being carried out which integrate data from digitized radar, aircraft, upper air and surface networks. A second objective is to develop new statistical tools to analyze relevant atmospheric processes. These tools will involve new multivariate formulations appropriate to skewed data, non-standard time series analyses, and a systematic study of the use of angular data in multivariate contexts.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0059, DEVELOPMENT OF METHODS FOR IMPROVED USE OF SATELLITE IMAGES AND SYNTHESIS WITH OTHER GATE DATA SETS

D. Suchman, University of Wisconsin, Madison Campus, Space Science & Engineering Center, *Agriculture Hall, Madison, Wisconsin* 53706 (ATM78-09716)

The objective of this research is to continue an ongoing program aimed at extracting meteorological information from the GARP Atlantic Tropical Experiment (GATE) geostationary satellite data sets. The emphasis during this year of funding will be to combine satellite and other GATE data sources to produce more complete and valuable data sets. Specifically, the objectives are: 1. Improve the methods whereby satellite, rawinsonde and aircraft wind data can be combined; this includes improving cloud tracking, especially of clouds in the middle troposphere.

In order to accomplish the above goal, work must continue on the improvement of methods for extracting more information from satellite image data. Consequently, to make the combined data set more useful, the project will: 2. Continue the improvement of cloud height and thickness determined by treating multiple cloud layers, and by adding local sounding data to the cloud height calculation. 3. Improve means whereby satellite brightness data can be used both to isolate deep convection and to be combined with radar echo intensity information as a means of mapping precipitation from satellite images. 4. Combine satellite and other data sources for the purpose of mapping clouds including the three-dimensional distribution of clouds, the stage and growth of convection, and cloud organization such as lines or squalls. 5. Improve the methods for viewing and analyzing clouds and cloud systems in a quasi-Langrangian frame of reference.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0060, ENVIRONMENTAL IMPACTS OF RESOURCE MOBILIZATION IN THE HUMID TROPICS/DEVELOPMENT IN QUINTANA ROO, MEXICO

C.R. Edwards, University of Wisconsin, Milwaukee Campus, School of Letters & Science, Dept. of Geography, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (SOC78-08475)

Quintana Roo, Mexico, until recently an underpopulated and underutilized tropical region, is presently undergoing massive development, the success of which will depend ultimately upon the congruence among cultural systems, development strategies, and the ability of ecological bases to sustain such development.

The 1955 predevelopment landscape will be reconstructed, and the processes and impacts of technological innovations in crop agriculture, livestock husbandry, lumbering, and fishing will be analyzed, using LANDSAT imagery as well as standard field observation, mapping, and interviewing.

This research will contribute to understanding the ability of humid tropical environments to meet expectations for increased food production and settlement of surplus populations. The historical-geographical reconstruction provides a base line for measurement of subsequent changes and their impacts, and is prerequisite to formulation of theory concerning the conduct and consequences of modern development in the humid tropics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral &
Social Sciences, Div. of Social &
Economic Science

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, LDF 79-2, AIRCREW PROTECTIVE RESTRAINT SYSTEM EVALUATION PROTOTYPE

B. McDonald, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (DF325320; F33615-79-C-0522)

Recent aircraft accident experience has resulted in high level reemphasis on techniques and equipment for aircrew restraint and escape. It is apparent that new approaches will be needed in order to achieve significant improvements in the injury and fatality rate. This effort will evaluate the feasibility and utility of novel concepts for aircrew protection against multiaxis acceleration associated with projected operational and escape environments.

The biomechanical protection branch is engaged in an advanced design contract effort to conceptually evaluate a number of innovative techniques in aircrew restraint system design. The techniques include adaptive support and restraint surfaces, powered torso and head reorientation, and conformable seat cushions for restraint and escape systems. These techniques are presently in the conceptual stage of development and will reach the design aid mock-up stage by approximately 1 January 1979. The opportunity will then be available to pursue an agressive aeromedical evaluation of the concepts establishing the potential for reduction in morbidity and mortality associated with escape. Improved operational restraint configurations also have potential for improving the performance of the human operator subject to multiaxis acceleration. Funding will be used to establish a contract effort to produce conceptual prototype equipment suitable for human centrifuge and impact testing of the aeromedical aspects of the concepts discussed above. The result of this effort would allow AMRL to pursue the evaluation necessary to substantiate potential improvements to be realized.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Aerospace Medical Research Lab.

6.0002, DEVELOPING ENHANCED SENSITIVITY TO VISUAL MOTION

R.W. Sekuler, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Psychology, *633 Clark St., Evanston, Illinois* 60201 (DF054600; AFOSR-79-0064)

AF function - this research supports aircrew training R and D, especially for tactical pilots flying high performance aircraft. Deficiency - there appear to be large and stable differences between people in their sensitivity to visual motion. This type of sensitivity is extremely important for many flying tasks, including a number of critical combat tasks. There is insufficient knowledge to know if these differences are real or artifacts of particular experimental designs. Further, there is no knowledge about whether these sensitivities can be improved through training. Objective - this research will study the range of differences in visual motion sensitivity, determine its locus, and develop candidate techniques which will improve the sensitivities of those on the lower end of the sensitivity spectrum and those on the upper end. How research contributes - this research will determine whether concern is indicated for pilots who might possibly have poor visual motion sensitivity, whether sensitivity can be improved and how, and whether sensitivity should be considered in selecting pilot candidates.

A series of experiments will be conducted to assess the range of motion sensitivities among a large population of subjects. Subjects with good sensitivity and those with poor sensitivity will be separated from the group and the effects of various training exercises will be evaluated. The results will indicate if the human visual system can become more sensitive to motion using these techniques, and whether this effect is as

strong for those whose sensitivity is already good as it is for those with poor sensitivity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0003, VARIABILITY OF HUMAN PHYSIOLOGICAL RESPONSES TO THERMAL STRESS

F.H. Rohles, Kansas State University, School of Arts & Sciences, Dept. of Psychology, *Anderson Hall, Manhattan, Kansas* 66502 (DF320440; F33615-77-C-0601)

This effort is to define man's inter- individual variability in physiological responses to heat. The findings will provide USAFSAM scientists with rationale and criteria required to establish realistic design specifications for modern aircraft environmental control systems.

A sample population will be selected that is representative of Air Force flying personnel, male and female, of sufficient number to permit meaningful statistical application of results to the entire population in question. Normal range of selected physiological responses when this population is exposed to rest in various hot-dry and hot-humid environments will be determined. The time course of recovery of these physiological parameters after the removal of thermal stresses will be charted. A technical report will be composed which will include a comprehensive discussion of (a) related literature, and (b) the experimental findings of this study with particular emphasis on the predictability of man's physiological responses to thermal stress.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0004, MALE/FEMALE DIFFERENCES IN FLYING SKILL ACQUISITION, FLIGHT SAFETY AND ACCIDENT PRONENESS, AND MOTIVATION FOR FLYING

J. Zwara, Aerospace Systems Inc., *121 Middlesex Tpke., Suite 202, Burlington, Massachusetts* 01803 (DF232860; F33615-77-C-0028)

To investigate civilian male/female differences in flying skill acquisition, flight performance and safety, and motivation for an interest in flying.

A threefold approach will be utilized. First, a review of civilian aircraft accident data will be undertaken with an emphasis on determining if either sex appears disposed towards a greater incidence or type of accidents. Second, a field survey will be administered to a sample of 750 FAA flight instructors, and third, a field survey will be administered to samples of 750 male and 750 female FAA pilots. The emphasis of the field survey will be to determine the existence and possible impact of sex difference. Milestones - Stage I, review of literature, 1.5 months, Stage II, preparation and approval of survey instruments, 3.0 months, Stage III, investigation of accident data (partly concurrent with Stage II), 1.5 months, Stage IV, survey administration, 2.5 months, Stage V, analysis, 2.5 months, Stage VI, preparation of final technical report, 3.0 months.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0005, PILOTING PARAMETERS FOR HANDLING QUALITIES RATING SCALE DEVELOPMENT

N.D. Geddes, Systems Research Lab. Inc., *500 Woods Dr., Dayton, Ohio* 45432 (DF056040; F49620-79-C-0158)

AF function - although the application of current control systems theory to pilot-aircraft systems has resulted in many insights into the complexities of man-machine interactions, the final test of an aircraft's acceptability is still the subjective opinion of the evaluation pilot. This subjective opinion is most commonly expressed as a numerical Cooper-Harper rating, possibly a pilot induced oscillation rating (PIOR), and detailed supporting comments. Deficiency - both the Cooper-Harper scale and PIOR scale, however, exhibit characteristics that often have resulted in criticism for both theoretical and practical reasons such as: (1) the scales are truncated and nonlinear, (2) interpretation of the adjectives of the scale varies from pilot to pilot, and (3) the ratings must be supported by detailed comments to permit identification of a deficiency with sufficient accuracy for design correction purposes. Objective - the research will assess the feasibility of applying the psychometric techniques of multidimensional or multivariate scaling to the development of subjective rating scales capable of evaluating the handling qualities of dynamic systems such as flight simulators and vehicle displays, and flight vehicles. How research contributes - such techniques can reduce the ambiguity and increase the information content of the rating system, allowing an easier interpretation by both the evaluation pilot and aircraft designer. The resulting increase in scale discriminability may make this approach useful for the evaluation of heretofore difficult to assess effects, such as simulator dynamic fidelity.

The research will conduct the feasibility assessment of multidimensional and multivariate techniques as three serial tasks - (1) identification of piloting cues, (2) formulation of candidate rating scales, and (3) establishment of an experimental protocol for testing the reliability of the candidate scales. The point of departure for this study will be the task requirements and sensations experienced by the pilots rather than the parameters which comprise the present engineering models such as the servo model, dual loop servo model, or optimal control model. It is intended that the experimental protocol will provide the bridge which ties the candidate rating scales to particular engineering parameters of design importance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0006, FIELD STUDIES ON APPLICATION OF NOISE-CHECK TECHNOLOGY FOR MONITORING AIRCRAFT NOISE

R.A. Lee, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF324600)

Current plans are for field surveys to be conducted in February 79 and May 79 with AF Occupational Environmental Health Lab (OEHL) participation to evaluate equipment and procedures under actual operational conditions. Instrumentation will be checked out under various weather conditions, operations, instrument location and aircraft types to insure the adequacy of equipment and procedures for the variety of Air Force applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0007, VOICE COMMUNICATION ANALYSIS, EVALUATION AND ENHANCEMENT

R.L. McKinley, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325110)

Current and future requirements call for analysis, evaluation and enhancement of voice communications. The objective of this effort is to improve voice communications in an operational environment.

The approach is to analyze, evaluate and enhance voice communication by laboratory test, utilizing a standard aircraft voice intercommunication system which is capable of reproducing a realistic and valid simulation of the operational environment. This includes a multi-station intercommunication system, a respiration system, appropriate terminal equipment (helmets, masks, headsets, etc.), accurate simulation of the spectra and levels of specific weapons systems air and ground noise environs, radio static, auditory warning signals and various communication situations such as quiet to noise, noise to noise, etc. An automated display and scoring approach is being incorporated into the system at this time. This will result in significant cost effective use by greatly reducing testing time, data collection and analysis and the number of items that can be evaluated per unit time. Semiannual review was accomplished 30 Sep 78 in conjunction with the preparation of the TMR.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0008, THE IDENTIFICATION OF PSYCHOPHYSIOLOGIC CORRELATES OF COGNITIVE PROCESSING
F.J. Bremner, Trinity University, School of Arts & Sciences, Dept. of Psychology, *715 Stadium Dr., San Antonio, Texas* 78212 (DF055850; F49620-79-C-0139)

AF function - a requirement exists for monitoring the brain activity of the pilot, evaluating his workload, his decision making ability, his workload processing ability, and his capability to respond to the system interface. Deficiency - the relationship of cortical events to the cognitive/information processing/decition making activities of mental processes has not been well documented. Also, it is not known how workload affects cortical events nor how fatigue affects electrophysiological correlates of cognitive processing. Objective - the research will (1) demonstrate the feasibility of using electrophysiological variables to assess the level of cognitive processing occurring at any given time in aircraft pilots, and (2) determine if variables previously shown to be potent in decreasing pilot effectiveness will also affect the electrophysiological variables associated with cognitive processing. How research contributes - the proposed research represents an initial attempt to explore and identify selected psychophysiologic correlates (electroencephalogram, visual evoked response, heart rate, and heart rate variance) of cognitive processing. In addition, it will be possible to evaluate the cortical effects of fatigue on these correlates.

Four subject groups will be selected. Group one will perform a high-cognitive processing task. Group two will perform a low-workload cognitive processing task. Group three will perform the high workload task plus be subjected to a situational state representative of cognitive fatigue. Group four will perform a non-cognitive processing control task. The dependent variables will be (1) electrophysiological, and (2) motor responses. The inherent EEG variables will be analyzed by means of a fast Fourier transform. The dependent variables will be submitted to a factor analysis. Results of the statistical treatments will identify predictor variables for future studies designed to expand current knowledge and use of brain monitoring technology in the context of the man/machine interface.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, UTILIZATION OF WOMEN IN NON-TRADITIONAL AREAS
J.A. Bergmann, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF234160)

To evaluate the impact of female assignment in non-traditional areas in terms of utilization,performance, attrition, training success, task requirements, and attitudes.

A job inventory, various task factor surveys, and attitude surveys will be administered to approximately 2000 females and a 2x1 matched male sample of 431x1 and 431x2 aircraft maintenance specialist job incumbents and their supervisors. A time 2 survey will be conducted 12 months after the initial survey. Milestones - instrument development, 4 MASD, field review and revision, 6 MASD, survey administration, 8 MASD, data reduction, 11 MASD, tech school analysis, 12 MASD, survey analysis, 17 MASD, documentation Phase I, 20 MASD, resurvey, 21 MASD, data reduction, 22 MASD, analysis and follow-up, 30 MASD, documentation Phase II, 33 MASD.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0010, AIR FORCE VALIDATION OF ASVAB FORMS 6 AND 7
J.J. Mathews, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233130)

To validate operational ASVAB subtests and composites against Air Force technical training performance criteria.

Current ASVAB tests will be correlated with technical training criteria. Some analyses will involve data which has been collected on 9,000 airmen experimentally administered ASVAB-7A. Possible sex and racial interactions in selector composite based prediction will also be investigated. In instances where feasible, new composites will be formed for appropriate technical courses. Operational ASVAB test data collected at field stations (data will be obtained from MARDAC tapes) will also be validated, and comparisons will be made between experimentally and operationally administered test results. Milestones -- field tested samples selected - 1 May 77 to 1 Jul 77, operational test analyses - 1 Jul 77 to 1 Nov 77, interim TR preparation - 1 Nov 77 to 1 Mar 78, ASVAB-7A samples selected - 1 Jun 77 to 1 Sep 77, ASVAB-7A analyses - 1 Sep 77 to 1 Feb 78, administration comparison - 1 Mar 78 to 1 Sep 78, final TR preparation - 1 Oct 78 to 1 Mar 79.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0011, DETECTION AND MEASUREMENT OF AMINE-BASED PROPELLANT VAPORS
L.J. Luskus, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF320860)

This work unit will develop detection methodology and breadboard instrumentation to measure toxic and subtoxic concentrations of amine-based propellants including hydrazine, MMH and UDMH. The requirement is based on occupational safety of workers involved in rocket testing, missile maintenance, and more recently in the projected worldwide deployment of F-16 aircraft which employs a hydrazine fueled emergency power unit.

Electrochemical and chemiluminescence instrumentation will be developed and evaluated for use as area and confirmation monitors. Personal dosimeters will be developed contractually with final evaluation testing accomplished under this work unit. Solid state devices and wet methods for field use will be developed and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0012, AUTOMATED AIDS TO ISD
P. Smith, Veda Inc., *1755 Jefferson Davis Hwy., Arlington, Virginia* 22202 (DN994031; N61339-79-C-0076)

Procure a contract to continue development of a system for aiding ISD activities for the application of ISD to naval aircrew training. The continuation of effort also will acquire: (a) a manual and instructional course on the use and completion of development of the system, (b) a specification and assessment of the source of anticipated benefits of the system, and (c) a final report on the activities and results of the effort.

Instructional personnel will develop and instruct NavTraEquipCen personnel in the development of data bases and application programs in a computer software format such that ISD data from previous ISD efforts can be accessed and applied to current ISD needs. These programs will be tested at NavTraEquipCen.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, APPLICATIONS OF THE ISING MODEL
E. Barouch, Clarkson College of Technology, School of Science, Dept. of Mathematics, *51 Main St., Potsdam, New York* 13676 (DMR77-11324 A01)

Continuation of research supported under DMR 75-07147.

Investigations of the mathematical properties of the Ising Model will be continued. In particular, the multi-spin correlations near the critical point will be calculated in order to determine the behavior of the isothermal magnetization and susceptibility of a magnetic crystal.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

7.0002, ROTATION AND CHARGE OF A BLACK HOLE IN RADIATIVE EQUILIBRIUM - QUANTUM TRANSITIONS, DISSIPATION, AND FLUCTUATIONS
U. Gerlach, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Mathematics, *164 W. 17th Ave., Columbus, Ohio* 43210 (PHY77-04983)

A program of theoretical research in gravitational physics will be initiated. Among the specific topics to be investigated are: 1. Black hole viscosity. 2. RMS fluctuations in charge and angular momentum induced by emission of quanta by a black hole.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

7.0003, HAMILTONIAN SYSTEMS AND CELESTIAL MECHANICS
K.R. Meyer, University of Cincinnati, McMicken College of Arts & Sciences, Dept. of Mathematics, *Van Wormer Adm. Bldg., Room 204, Cincinnati, Ohio* 45221 (MCS78-01425)
Renewal of MCS-7505862.

This project concentrates on the quantitative and qualitative theory of differential equations, with special emphasis on Hamiltonian systems. For the latter, periodic solutions will be considered. Lie transformations will figure in this work, both in the qualitative theory and in the asymptotic methods. Applications to the N-body problem and to lunar theory will be considered.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0004, COMPUTER-AIDED GEOMETRIC DESIGN
R.E. Barnhill, Utah Higher Education System, University of Utah, School of Letters & Science, Dept. of Mathematics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (MCS78-01966)

Computer-Aided Geometric Design (CAGD) is the effective computer representation of curves and surfaces. CAGD enables one to quantify mathematically and then to design interactively free-form curves and sculptured surfaces. Applications include the design of surfaces of airplanes, automobiles, ships, and the finite element analysis of these surfaces. Additional applications include the display of the surface of the human heart and of the earth. Computer graphics is integral to this research. The underlying mathematics for surfaces are variations of Coons patches for rectangles and triangles and of Shepard's Formula for arbitrarily spaced data. For curves, B-splines are used. Geometric handles for surface manipulation from a data tablet have been devised. This graphical software is necessary for real-time surface recomputation. This research is a combination of mathematical and computer software, requiring research contributions from Mathematics and Computer Science.
This is a continuation of grant MCS-7413017 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, MEASUREMENT OF ATOMIC TRANSITION PROBABILITIES
W. Whaling, California Inst. of Technology, Graduate School, Dept. of Physics, *1201 E. California Blvd., Pasadena, California* 91109 (AST76-81607 A01)

This research program will be concerned with measuring atomic transition probabilities useful for the quantitative analysis of hot gases and plasmas. The transition probabilities for various atomic species can be measured by (1) beam-foil time-of-flight-measurements of the radiative lifetime of a level, followed by (2) branching ratio measurements to apportion the total transition probability among the individual transitions by which the level decays.

Transitions to be studied will be those that are prominent in astrophysical spectra. For neutral and singly charged ions, the experimental procedure includes a comparison with solar measurements to test the internal consistency of the measured transition probabilities. There will be measurements on the resonance lines of doubly ionized iron, and the ultraviolet spectrometer will be used to measure transition probabilities for other prominent lines in the wavelength region of 1200-2000 angstroms. Studies of transitions important for ground-based astronomy will deal with cobalt, samarium, and vanadium.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0002, THEORETICAL STUDIES OF INHOMOGENEOUS ELECTRONIC SYSTEMS IN SOLIDS
H.B. Shore, California State University & Colleges, San Diego State University, School of Sciences, Dept. of Physics, *5402 College Ave., San Diego, California* 92115 (DMR77-11532 A01)

Theoretical investigations in solid-state physics previously supported by NSF grant DMR-7203107 A01 will be continued and extended in new directions. Calculations will be done on the surface energy of simple metals within the density functional formalism of Kohn and Sham, using newly developed non-local corrections to the exchange-correlation energy. The methods used for this calculation will also be applied to other problems involving the inhomogenous electron gas: the energy of solution of hydrogen in metals using the spin-dependent version of the density functional formalism and the behavior of the above calculation in the limit of very low electronic density. Also, inhomogenous electron gas methods will be applied to the problem of the electron-hole liquid in semiconductors. Problems to be investigated include the surface energy of a droplet, the binding energy of the liquid to an impurity, and the stabilization energy of exciton complexes by a point charge. Included also will be study of lithium impurities in silicon.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0003, PSEUDOPOTENTIAL METHODS IN PHYSICS
W.A. Harrison, Stanford University, Graduate School, Dept. of Applied Science, *Stanford, California* 94305 (DMR77-21384)

This is a continuation of research previously supported under DMR-7302351. Theory relating the electronic structure of solids to the dielectric and bonding properties of those solids will be developed. A systematic set of matrix elements for transition-metal solids, analogous to those for simple solids, will be derived from the known electronic structure of a number of such systems. Calculations of various properties will be carried out in terms of these parameters. Also, elementary LCAO theory will be applied to covalent and ionic solids.
This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0004, SURFACE PROPERTIES OF METALS AND SUBSTITUTIONAL ALLOYS AND THEIR RELATIONSHIP TO CATALYSIS
W.E. Spicer, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DMR77-23442)

This is a continuation of studies on surface composition electronic structure, chemisorption and surface reactions on bimetallic surfaces. The overall goal is to provide critical knowledge toward understanding surface reactivity and catalysis. Single crystals and bulk samples will be examined at low pressures by ultraviolet photoelectron spectroscopy with conventional light sources and also with synchrotron radiation, Auger electron spectroscopy, low energy electron diffraction, tempera-

ture programmed reactions and desorption. The results obtained at low pressures will be compared to catalytic activity measurements on small metal particles at pressures near one atmosphere. Specifically, reactions between H2 and preadsorbed oxygen at low pressures, will be studied, first on single crystals of Pd as a reference metal and then started on selected PdAu bimetallic bulk samples. These studies will help to understand previous catalytic studies pertaining to the reaction between H2 and O2 on small Pd and Pd/Au particles at high pressures. The combined experimental results will be used to elucidate the mechanism of the hydrogen-oxygen reaction, both at low and high pressure. A second bimetallic to be investigated is the Cu-Ni system which was extensively studied in the previous grant period. The research will be extended to include the effect of the bimetallic surface composition on the selectivity of the decomposition of formic acid to form CO and CO2. The results obtained on well-characterized single crystal surfaces at low pressures will be compared to those on small particles at high pressure. The combined data will be used to assess again the relationship between studies done on single crystals at low pressures to those done on small particles at high pressures. In addition experimental work will be done on formaldehyde and methanol decomposition on the Cu-Ni alloys.

To gather a more fundamental understanding of the interactions between metal and absorbed gases which is the essence of the catalytic process, a program recently initiated involving photoemission measurements (including angularly resolved work) and theoretical work will be continued. The prime objective of this work is to increase understanding of the relationship between the electronic structure of the metal and its interaction with the adsorbed gas. (Text Abridged)

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, STUDY OF X-RAY ANOMALOUS DISPERSION AND ITS APPLICATION

A.I. Bienenstock, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305
(INT77-06310)

Scientists of the Stanford Synchrotron Radiation Project (SSRP) and the Institute for Solid State Physics, University of Tokyo, will collaborate on high energy resolution, accurate measurements of the anomalous dispersion changes of atomic X-ray scattering factors as a function of photon energy near absorption edges as well as comparisons of these changes with existing calculations. Specific samples to be studied include GaAs, GaP, ZnS, and PbS. The changes will be obtained through measurement of the energy dependences of the radiation provided by the storage ring SPEAR at SSRP. This award supports travel and subsistence costs for Dr. Bienenstock and Dr. Hastings in Tokyo; the Japanese Society for the Promotion of Science will support costs associated with Dr. Hosoya and his colleagues travel and subsistence at Stanford.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0006, MAGNETIC STRUCTURES AND FIELD RECONNECTION - MECHANISMS OF SOLAR-TERRESTRIAL ACTIVITY

G. VanHoven, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664
(ATM77-09581 A01)

Sheared magnetic fields and current-sheet dynamics are believed to dominate solar and magnetospheric activity. This grant has several related objectives concerning the fields and currents. They include the study of nearly force-free magnetic structures in non-uniform situations and the further consideration of loop configurations, with attention to their flare, or resistive-instability, behavior. A desire to improve on a magnetic-tearing model underlies the investigation of modifications of the basic mechanism due to heating effects (connected with the thermal instability) and secondary observable characteristics, such as acceleration and resistivity (flare-phase) transitions.

The ultimate aim of this research is the development of empirical tests which will demonstrate the reality of the various proposed solar (and auroral) field-structure and flare-reconnection models, including those involving resistive tearing.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0007, EXPERIMENTAL STUDIES OF ONE-DIMENSIONAL ORGANIC METALS, ONE-DIMENSIONAL INSULATORS, AND NEW SUPERCONDUCTING MATERIALS

W.G. Clark, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024
(DMR77-23577)

An experimental research program to study the polymeric superconductor polysulfur-nitride (SN), the superconducting rare earth molybdenum selenides, and several types of pseudo one-dimensional (1-D) materials is under way. The superconducting properties of (SN)x are investigated at temperatures as low as 7 millikelvin through measurements of the critical field, critical currents, specific heat, and thermal conductivity. One of the quantities sought is the superconducting energy gap. Chevrel-phase superconductors, such as Gd1.0Mo6Se8, are studied by measurements of specific heat at very low temperatures in external magnetic fields up to 80 kG to test for the coexistence of ordered magnetism and superconductivity in this material. The magnetic properties of the ground and low-lying excited states of several highly conducting, pseudo one-dimensional charge transfer salts will be studied using nuclear magnetic resonance, susceptibility, and specific heat measurements at very low temperatures.

First year of a three-year continuing grant. This is continuation of research supported under DMR 73-07612.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, EXCITED STATE CROSS-SECTIONS IN CARBON MONOXIDE

R. Poe, University of California, Riverside Campus, School of Physical Sciences, Dept. of Physics, *Riverside, California* 92502
(DF461220; F33615-77-C-2011)

Obtain theoretical values for electron impact cross sections in carbon monoxide. Cross sections will include momentum transfer, rotational, and vibrational excitation for ground and excited vibrational-rotational states.

Semi-classical and quantum methods will be employed in numerical solutions of inelastic scattering of electrons from molecules with permanent dipole moments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

8.0009, GENERAL RELATIVITY AND RELATIVISTIC ASTROPHYSICS

J.B. Hartle, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106
(PHY78-09620)

Research in gravitation theory supported under NSF Grant PHY76-08551 A01 will be continued. Among the topics to be investigated are: 1) Particle production in the early universe. This process is the most promising mechanism to explain the large scale homogeneity and isotropy of the universe, and the observed photon to baryon ratio. 2) Black holes and gravitational collapse: They may explain the enormous energies necessary for the activity of quasars and galactic nuclei. 3) Relativistic stellar structures: Studies will concentrate on the possible end states of stellar and galactic evolution associated with rapidly rotating objects.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0010, NEW EFFECTS IN MULTIPHOTON ATOMIC AND MOLECULAR PROCESSES

P.P. Lambropoulos, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (PHY78-23812)

Research in theoretical atomic physics initiated under NSF grant PHY76-23163A01 will be continued. Among topics in multiphoton processes to be investigated are: 1) atomic structure calculations; 2) electric quadrupole effects; 3) photon correlation effects; 4) AC Stark splitting; 5) light-polization and electron-spin effects; 6) resonance effects; 7) quantum beat phenomena; 8) resonant harmonic generation; 9) strong field effects; 10) resonance multiphoton processes; and 11) stochastic properties of nonmonochromatic fields.

These investigations will deal with basic aspects of multiphoton processes as well as their application to spectroscopy, laser isotope separation and ionization under very strong fields.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0011, ORIGIN OF COMETS AND THE EVOLUTION OF THEIR ORBITS

E. Everhart, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (AST7817513)

Support is to continue a study of the interaction of comets with the solar system using Monte Carlo methods. Besides planetary perturbations, which change the total energies of the comets, the impulses caused by passing stars will also be included for these can make large changes in the perihelia of comets. In comparing the distributions generated by a realistic model with the distributions for real comets, one can get information about dissipation and observational selection effects. Thus, one can find numerical values for the average probability that a comet will be observed on various returns. Another part of the study is to investigate the past and future orbits for a few well-known objects, such as Chiron, a small body with a perihelion at 8.4 times the earth's distance from the sun, recently discovered by Kowal. In particular, calculations will be carried out to find out if Chiron is in a stable libration orbit, or whether it is in an orbit which is chaotic or random in character.

Prior support was by NSF grant AST 76-18891.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0012, SPECTROSCOPY OF ELECTRONS IN INVERTED METAL OXIDE SEMICONDUCTOR STRUCTURES

R.G. Wheeler, Yale University, Graduate School, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (DMR78-20071)

Research on the quasi-two-dimensional electronic subbands in a semiconductor surface inversion layer, previously supported under grant DMR 7514026, will be extended to very thin (5-10nm) oxide structures. In this regime electron-electron interactions are deemphasized, thus narrowing the energy width of the subband levels and modifying the infrared tuning characteristics of the silicon MOSFET (metal-oxide-semiconductor field effect transistor). Infrared spectroscopy, photoconductive and Hall effect measurements will be made on (100) and (110) silicon surfaces and a search undertaken for a new effect, plasma resonances in the non-continuum region.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0013, TOPICS IN THEORETICAL PLASMA PHYSICS

I.B. Bernstein, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (PHY78-08433)

Research in theoretical plasma physics currently supported under NSF grant PHY76-06191 A01 will be continued. The topics to be investigated include the following subjects: (1) The linear geometric optics theory of the relativistic free electron laser will be extended to determine the gains to be expected, taking into account effects such as realistic geometrics, the back reaction of the high-frequency fields on the beam, and the influence of beam electron density fluctuations. (2) The theory of laser initiated plasma diode will be developed so as to determine in self-consistent fashion the electromagnetic fields, and charged particle densities and temperatures, so as to interpret the on-going experiments and assess the utility of the device for isotope separation. (3) A quasi-linear theory will be developed describing the action of turbulent microfields on quasi-static particle distribution functions f, taking into account special variation of both microfields and f.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0014, CONDENSED MATTER SCIENCE - NUCLEAR RESONANCE STUDIES AT HIGH PRESSURE AND LOW TEMPERATURE

T.A. Scott, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Physics, *208 Tigert Hall, Gainesville, Florida* 32601 (DMR77-08658 A01)

This established research program on condensed matter is being continued with a wide variety of experiments on solids and liquids at low temperature and high pressure. Nuclear magnetic and nuclear electric quadrupole resonance spectroscopy are used. Work is concentrated on relatively simple and important molecular systems, such as nitrogen, carbon monoxide, chlorine, hydrogen chloride, etc., with the objective of attaining an in-depth understanding of their intermolecular potentials and physical properties over an extended range of pressure, volume, and temperature. Specific areas under study include molecular and solid-state structure; phase transitions and their pressure-temperature phase stability boundaries; order-disorder processes; ferroelectricity; magnetic shielding anisotropy in solids; the Knight shift in metals; electric field gradients in anisotropic metals and nonmetallic materials; nuclear relaxation processes due to diffusion and other forms of molecular motion in solids, liquids, mixtures, and microemulsions; isotope effects and defect properties. Novel experiments on rare isotopes, including both stable and radioactive species, are planned. Pulsed quadrupole resonance techniques are being developed for observing the very broad lines often encountered in disordered systems, as are procedures for performing nuclear resonance experiments at pressures up to 70 kbar.

This is a continuation of research supported under DMR 75-20161. First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, OXYGEN-SULFUR, AND CARBON CHEMISORBED ON IRON USING ANGLE RESOLVED PHOTOEMISSION

M.W. Ribarsky, Georgia Inst. of Technology, School of Physics, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DMR77-22851)

This combination of experiments is a useful tool for investigating the mechanisms of the adsorption process, which is an intermediate step in many catalytic reactions.

A coupled experimental and theoretical study of oxygen, sulfur and carbon adsorbed on the low index faces of iron will be carried out. Angle resolved photoemission spectroscopy (ARPS) using both a discharge source and synchrotron radiation will be the primary tool in this work. Angle integrated photoemission, Auger spectroscopy (AES) and low and medium energy electron diffraction (LEED) and (MEED) also will be used. Island formation and growth will be followed by AES and LEED, while island sizes will be determined by LEED spot profiles. The mechanisms of island formation will be studied with emphasis on the changes in bonding accompanying changes in island structure and growth as indicated by ARPS and LEED.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, A THEORETICAL STUDY OF NUCLEAR STRUCTURE AND INTERMEDIATE-ENERGY NUCLEAR REACTIONS

J.T. Londergan, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (PHY77-07656 A01)

Research in theoretical nuclear physics initiated under NSF grant PHY75-07803 A01 will be continued. Topics to be investigated include: I. Electromagnetic Interactions. A) Theory of the (gamma, N) interaction at medium energies (Londergan, Nixon). B) Formulation and investigation of intermediate isobar production in (e,electron) and (e,electron p) (Londergan, Walker, Conte). II. Nucleon-Nucleus Interactions. A) Continuation of ongoing program in (p,p), (P,2p) and (p,d) reactions with emphasis on interpretation of new data and model studies of two-step processes, (Walker, Picklesimer). B) Field theoretic and multiple scattering formalisms (Londergan, Weiss). III. Pion Physics. A) Microscopic field theoretic pion-bound nucleon and pion-nucleus formalism (Walker). B) Pion-nucleus quasi-elastic scattering (Walker). C) Study of the pion-nucleon inverse problem with isobars (Londergan). IV. Weak Interactions. Muon production by medium-energy protons (Walker, Weiss). V. Kaon-Nucleus Interactions. The K ion probe as a tool for studying nuclear structure with emphasis on inelastic scattering and knockout reactions (Walker). VI. Heavy Ion Physics. VII. Nuclear Structure.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0017, ELECTRONIC TUNNELING FROM METALS (QUASIPARTICLE INTERFERENCE)

W.J. Tomasch, University of Notre Dame, College of Science, Dept. of Physics, *Notre Dame, Indiana* 46556 (DMR78-12994)

Electron tunneling experiments will be performed to examine the modification of the excitation spectrum due to perturbing the energy gap at one surface of a thick superconducting film. The tunneling measurements will be used to measure the quasiparticle velocities at the Fermi surface, to determine changes in the electron-phonon interaction that occur near the Fermi surface and to study the influence of proximity effect phenomena on the formation of energy levels. These measurements will be made on Zn, Cd, Tl and possibly Sn. Exploratory studies will be made of phonon-related structure in the tunneling characteristics of very thin binary films. These studies are important for the understanding of non-equilibrium superconductivity and the electronic devices based on this phenomenon. This is a continuation of work supported under DMR76-16998.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, DENSITY FUNCTIONAL THEORY OF METALS AND METAL SURFACES

J.P. Perdew, Tulane University of Louisiana, School of Arts & Sciences, Dept. of Physics, *6823 St. Charles Ave., New Orleans, Louisiana* 70118 (DMR78-12398)

Theoretical research in metal physics will be carried out using the density functional theory of the inhomogeneous interacting electron gas. This method will be used to investigate the face-dependence of the metallic surface energy, work functions, lattice relaxation at a surface and the surface plasmon dispersion. Also, a variational study will be made of the relative stabilities of the paramagnetic state and the spin-and charge-density waves in metals. In addition, extensions of the theory will be developed, by adding the effects of local pseudopotentials and the exchange corrections to the random phase approximation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, SURFACE CRYSTALLOGRAPHY AND SURFACE THERMAL PROPERTIES USING RUTHERFORD BACKSCATTERING AND LOW-ENERGY ELECTRON DIFFRACTION

W.N. Unertl, University of Maine, Orono Campus, School of Arts & Sciences, Dept. of Physics, *36 Winslow Hall, Orono, Maine* 04473 (DMR77-28543)

This is a basic investigation of structural and thermal properties of the crystal surface of Pt and Ni, using both Rutherford backscattering and low energy electron diffraction techniques. The objectives of this study are threefold: (1) to gain insight into the relationship between surface crystallography, interatomic force constants, and their deviations from bulk behavior; (2) to advance technique development for surface structure determination; and (3) to develop new methods to investigate the nature of surface defects and disorder. The experiments are designed to yield quantitative information about surface defect structure, including stepped surfaces, and to provide new insight into microscopic processes at solid surfaces. The experiments will be performed at the Rutherford backscattering/low-energy electron diffraction facility at the Canadian Chalk River Nuclear Laboratories.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0020, SOLID-STATE STUDIES USING THE MOSSBAUER EFFECT

J.C. Walker, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (DMR77-07127 A01)

Mossbauer effect experiments will be carried out to observe the microscopic behavior in a variety of magnetic materials. The effects of sample thickness on the magnetic properties of ultra-thin films will be examined. Epitaxially grown films of iron with thicknesses between 10 and 220A will be made with the critical temperature and the nature of the magnetic order to be measured using Mossbauer spectroscopy.

Some splat-cooled Fe40, Ni40, B20-type amorphous ferromagnets will be used to study the spin-wave behavior and the magnetic phase transition as well as the magnetostriction. Mossbauer measurements will be made using an RF sideband technique developed by Chien and Walker to measure the magnetostriction.

A study of iron-poor FePd alloys will be made in an attempt to establish a closer connection between the magnetic properties of disordered alloys and those of amorphous ferromagnets.

This is a continuation of research previously supported under DMR75-13354.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, DETERMINATION OF THE MECHANISM OF HIGH-POWER ULTRASONIC SOFTENING OF METALS

R.E. Green, Johns Hopkins University, School of Engineering, Dept. of Mechanics, *34th & Charles Sts., Baltimore, Maryland* 21218 (DMR78-05944)

Although it has been known for at least twenty years that the application of ultrasonic vibrations of sufficient amplitude during tensile deformation of metallic materials reduces the stress required for further deformation, the mechanisms causing stress reduction are not understood. The objective of this research is to undertake experiments in which all proposed mechanisms for high power ultrasonic softening are measured simultaneously during insonation of a variety of single crystal and polycrystalline metallic specimens which are undergoing tensile elongation. The materials under investigation include single crystals of aluminum and zinc, and polycrystalline aggregates of aluminum, zinc, steel, copper, brass, magnesium, and titanium alloys. The various parameters being measured simultaneously are the applied tensile load; the specimen elongation; the contract force between ultrasonic horn and test specimen; the electrical power input to the horn; the high power insonation; the vibrational amplitude of horn, specimen, and grips; the tempera-

ture distribution in the test specimen; the linear elastic longitudinal wave speed; and the ultrasonic attenuation. It is expected that the results of this research identify the mechanisms responsible for high power ultrasonic softening of metallic materials, and advance basic understanding of the nature of interactions between stress waves and dislocations in metallic materials. This is a continuation of research, previously supported under NSF Grant DMR76-02537.

This is the first year of a three year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0022, ELEMENTARY PARTICLE THEORY AND QUANTUM FIELD THEORY
O.W. Greenberg, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (PHY76-16562 A02)

Work is proposed in several areas of elementary particle theory. Among the subjects which will be studied are: spontaneous symmetry breaking in SU(4)4, 'naturalness' of atomic parity conservation within left-right symmetric theories, excitation of color degrees of freedom, astrophysical implications of present developments in elementary particle physics, and properties of bound states in relativistic quantum field theories.

This work is a continuation of that currently supported under NSF grant PHY76-16562 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0023, THEORETICAL STUDIES OF NONLINEAR PHENOMENA IN PLASMAS
C.S. Liu, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DN775702; N00014-77-C-0590)

Investigate nonlinear phenomena in plasmas with particular emphasis on fundamental problems related to the generation of localized field entities called solitons. This work provides improved information needed for solution to the problems of nonlinear effects in plasma experimental test systems which relate to Navy applications such as directed energy and weapons simulation.

Study the analytic properties of nonlinear wave equations in inhomogeneous media. Perform a theoretical investigation on certain fundamental problems in nonlinear plasma physics related to the generation of solitons. Specifically, this includes a theoretical analysis of solitons and parametric instabilities in inhomogeneous, magnetized plasmas and their role in plasma turbulence and particle acceleration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0024, THEORETICAL STUDIES OF GRAVITY
C.W. Misner, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (PHY78-09658)

Theoretical research on general relativity and related topics will be carried out. The principal areas of research will be (1) the development of a class of non-linear quantum field theories that model a type of gravitational non-linearity different from that modelled by Yang-Mills theories, (2) further development and applications of geometrical spacetime perturbation theory, (3) studies of black holes, including estimates of quantum influences on the nature of their hidden internal singularities and probes of the 'cosmic censorship' hypothesis through attempts to convert black holes into naked singularities. Other problems will also be studied when they seem apt for solution and significant for a fundamental understanding of gravity and its relationship to the rest of physics or astrophysics.

This work is a continuation of that currently supported under NSF grant PHY76-20029 AO1.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0025, POSITRON ANNIHILATION MEASUREMENTS IN LOW-TEMPERATURE HELIUM
K. Canter, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (DMR78-09199)

Measurements will be made of the annihilation rates of positrons (antimatter electrons) and positronium (electron-positron bound states) in low temperature helium gas and liquid. Experiments are designed to separate the atomic from many-body features of positronium trapped in helium by contrasting annihilation data from helium-3 and helium-4. An understanding of the trapped mechanism will lead to a clarification of the behavior of waves in disordered systems.

This is a continuation of research supported under DMR-7602041. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, THEORETICAL PROBLEMS IN CONDENSED MATTER AND STATISTICAL PHYSICS
P.C. Martin, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Biophysics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DMR77-10210 A01)

Continuation of research supported under DMR75-02649.

Theoretical research on a wide variety of problems in condensed matter science will be carried out. These include: (1) The statistical mechanics of systems near a critical point with applications to multicritical points, effects of impurities on magnetic systems and liquid crystal phase transitions. (2) Dynamical critical phenomena, utilizing the theory of the renormalization group on liquid helium, He3-He4 mixtures, structural phase transitions and spin-waves. (3) Solvable models of one-dimensional Fermi systems, such as an electron gas and coupled electron chains. (4) The study of the onset of turbulence in fluids. (5) Electronic properties of transition metals, alloys and compounds, e.g., transition metal hydrides. (6) Investigations of disordered systems, such as liquid and amorphous metals and spin glasses. (7) Layered superconductors and non-equilibrium superconductivity.

Other miscellaneous topics will be investigated such as spinodal decomposition, the dynamic structure of fluids, superradiance, photoemission, L/F noise and the origin of the earth's magnetic field.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0027, EXCITATION OF METASTABLE ATOMIC HYDROGEN BY LOW-ENERGY ELECTRONS
J.C. Zorn, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY77-18832)

This grant initiates an experiment in atomic physics to measure the differential cross section for excitation of a particular excited state (the 2 2 S 1/2 state) of atomic hydrogen by impact of low-energy electrons. The cross section for this fundamental collision process has been calculated many times in a variety of approximations, but there is no data on the differential cross section in the interesting energy range of 0-1.4 eV above threshold. The time-of-flight experiment used here is particularly well suited for cross section measurements in the near-threshold regime. It avoids the electron optics problems inherent in conventional cross section determinations, and it provides values of the cross section over the complete range of 0-180 degrees.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0028, TUNNELING IN MAGNETIC SUPERCONDUCTING SYSTEMS
A.M. Goldman, University of Minnesota, Minneapolis Campus, Inst. of Technology, Dept. of Physics, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DN875609; N00014-78-C-0619)

This study of the superconducting and magnetic properties of thin-film rare-earth chevral phase materials is of interest to the Navy for possible use in high power microwave weapons systems exploiting superconductors.

Thin films of rare-earth chevrel-phase superconductors (e.g., HoMoS, TbMoS and ErMoSe) will be prepared by RF sputtering. Diagnostic techniques used to characterize these films will include x-ray diffraction, transmission electron microscopy and Auger electron spectroscopy. The interplay between magnetic ordering and superconductivity will be studied using both quasi-particle and air-tunneling techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0029, MULTI-USE GAMMA RAY SCATTERING FACILITY

W.B. Yelon, University of Missouri, Columbia Campus, Research Reactor Facility, *130 Jesse Hall, Columbia, Missouri* 65201 (DMR76-17349 A01)

A high resolution gamma diffractometer will be built at the University of Missouri Research Reactor to study some basic properties of some simple systems. There include a study of the defects in doped-silicon by Huang Defect Scattering (HDS), plastic deformations of some perfect crystals by HDS and high resolution studies of covalency effects in simple metals by accurate determination of the structure factors. The possibility of performing inelastic scattering studies as well as some other possible uses of an intense, monoenergetic gamma-ray source will be investigated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, MICROSCOPIC THEORY OF QUANTUM FLUIDS AND EXTENDED NUCLEAR SYSTEMS

J.W. Clark, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DMR78-08552)

Research previously supported by DMR76-14929.

Theoretical research in condensed matter and nuclear physics will be carried out. The emphasis will be on the microscopic theory of dense quantum systems, with application to liquid helium, nuclear structure and astrophysics. The specific projects to be undertaken include: (1) the evaluation of the one- and two-body density matrices of quantum fluids, (2) the development of hypernetted-chain methods for the calculation of distribution functions, (3) the application of the method of correlated basis functions to the ground states of liquid helium-three and nuclear matter, (4) investigations of non-uniform phases of extended nuclear systems, and (5) the calculation of the low states of the closed-shell nucleus, oxygen-16, in a correlated subspace.

The main thrust of this research is the development of the method of correlated basis functions, which is an accurate technique for calculating ground state properties of interacting particles. This will lead to an enhanced understanding of the behavior of realistic systems at the microscopic level.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, ACOUSTIC MAGNETIC RESONANCE STUDIES OF METAL HYDRIDES, BULK METALS AND PARAMAGNETIC INSULATORS

D.I. Bolef, Washington University, School of Engineering & Applied Science, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DMR78-11567)

Acoustic magnetic resonance investigations of metal hydrides, bulk metals and semiconductors, and of magnetoelastic and spin-lattice relaxation effects will be carred out via nonresonant, (delta m equals O) interactions in paramagnetic systems. Special emphasis is placed on use of a high field superconducting magnet with homogeneity and sweep capabilities particularly suited for the investigation of metals and metal hydrides by nuclear acoustic resonance (NAR). These experiments will make use of the dynamic Alpher-Rubin coupling as well as dynamic quadrupole coupling mechanism. Particular areas that will be addressed are NAR of hydrogen via dipolar coupling in alpha, beta, and mixed phases of transition metal hydrides and NAR in single crystals of Be, Mg, and Ge.

This research was previously supported under NSF grant DMR-7680158, and DMR-7400360. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0032, TRICRITICAL PHENOMENA AND DYNAMICS OF HYDROGEN-BONDED CRYSTALS

V.H. Schmidt, Montana State University, School of Letters & Sciences, Dept. of Physics, *Bozeman, Montana* 59715 (DMR78-09205)

The 'critical' point in a liquid-gas system is the temperature and pressure at which it is impossible to distinguish between the liquid and gas, i.e., the surface tension goes to zero. Other types of systems, such as magnetic systems, superfluids, and those with turbulent flow also show critical phenomena. A recent major development in a unified theoretical treatment of all these phenomena. The importance of Professor Schmidt's work is that the ferroelectric, hydrogen bonded salts (such as KH2PO4) are different from other types of systems studied, have four variables that can be changed at will, and thus offer a specially favorable opportunity to examine dynamic effects near tricritical points and to test theory of critical phenomena.

Static and dynamic phenomena associated with phase transitions are investigated in potassium hydrogen (or deuterium) phosphate-type ferroelectric crystals by means of dielectric, nuclear magnetic resonance, birefringence, Brillouin scattering, and/or neutron scattering measurements. These measurements are made at various temperatures and pressures, with various applied electric fields, and with varying degrees of deuteration to examine behavior near the critical lines in temperature-pressure-electric field space and near the tricritical point which occurs at about 2.4 kbar in KH2PO4.

This is a continuation of work supported under DMR 76-11828.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0033, ELECTRONS IN COMPLEX SOLIDS

D.J. Sellmyer, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (DMR78-10781)

The object of this research is the investigation of electronic and magnetic states in relatively complex solids. These materials either exhibit new types of physical phenomena or require new theoretical models for their understanding. Several classes of problems will be studied: (1) electronic structure of d and f band metallic compounds, (2) electronic and magnetic states in limited dimensionality conductors, and (3) electronic and magnetic states in metallic glasses.

The experimental work will consist of high-field magnetoresistance and quantum oscillatory measurements in fields up to 220 KOe. In systems where electronically driven or magnetic phase transitions are involved, electron transport, magnetic susceptibility, and high-field magnetization measurements will be performed.

The results should contribute to our understanding of (1) the relationship between electronic structure and magnetic, structural, and superconducting phase transitions, (2) the relationship between electronic structure and chemical bonding in structures where the bonding is poorly understood, (3) the localized-moment and itinerant-electron aspects of magnetism in conducting solids, (4) the electronic structure and electron-transport properties of intertransition-metal amorphous alloys, and (5) the dependence of the magnetic properties of glassy metals on fluctuations of exchange constants, local random anisotropy, charge transfer, and structural effects.

This research was previously supported under DMR-7617417. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, THERMODYNAMIC AND DIELECTRIC PROPERTIES OF POLAR FLUIDS
J.L. Lebowitz, Rutgers the State University of New Jersey, New Brunswick Campus, Graduate School, Dept. of Physics & Mathematics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (CHE78-08730)

This project is in the Structural Chemistry and Thermodynamics program, in the subarea of liquid state theory. Dr. Lebowitz and Dr. Wertheim will study the dielectric and thermodynamic properties of dense systems of polar molecules by theoretical methods. The methods to be used are graphical techniques and thermodynamic perturbation theory. Some effort will also be devoted to development of formal theory and rigorous results. The research will be directed towards understanding the behavior of models of polarizable polar molecules, which are closer approximations to real molecules than the non-polarizable models mostly studied so far. Results will be compared with computer simulation, carried out elsewhere, and experiment, where appropriate.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0035, PIEZO-SPECTROSCOPIC INVESTIGATION OF BANDS AND BONDS IN SOLIDS
F.H. Pollak, City University of New York, Brooklyn College, School of Science, Dept. of Physics, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (DMR78-03030)

The stress induced splittings and shifts of the electronic energy bands and phonon frequencies will be investigated for a number of different solids. Uniaxial stress provides a tool for probing locations of band extrema, symmetries of interband transitions, deformation potentials, crystal field splittings, effective masses and excitonic transitions. The techniques to be used in these investigations include optical modulation spectroscopy, Raman scattering and resonance Raman scattering. Solids to be investigated include rutile materials, transition metal oxides and copper oxide.

This is a continuation of research previously supported by NSF grant DMR-7518936 at Yeshiva University.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, SUPERFLUID HELIUM-3 IN HIGH MAGNETIC FIELDS
D.M. Lee, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DMR78-10901)

This is a continuation of work performed under DMR-7621669. The properties of superfluid helium-3 in very high magnetic fields will be studied. The temperature dependence of the properties of the A-1 phase will be examined. Ultrasonic attenuation, high-frequency nuclear magnetic resonance, Andronikashvili techniques and possible fourth sound measurements will be employed in these studies. This work is important for understanding the behavior of quantum fluids.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0037, A STUDY OF HOMOGENEOUS STEADY-STATE PLASMA IN RF ELECTROMAGNETIC FIELDS
H.H. Brown, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (PHY77-26928)

A new device will be constructed to form and maintain a plasma in a heated cavity. Barium atoms will be ionized so that optical diagnostics can be used to obtain detailed information concerning the plasma. The hot walls will form part of an RF cavity so that microwave diagnostics can be used as a diagnostic and to supply an RF electric field for plasma interactions. Phenomena to be studied include: the effect of a ponderomotive force, parametric instabilities, and turbulence.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0038, ELECTROMIGRATION IN METALS
H.B. Huntington, Rensselaer Polytechnic Inst., School of Science, Dept. of Physics & Astronomy, *110 8th, Troy, New York* 12181 (DMR77-24953)

Research previously supported by DMR76-81239.

The phenomenon of electromigration in metals will be studied. Of the projects to be pursued, two deal with interstitials, i.e., 'fast diffusers' in lead and other polyvalent metals, and gaseous impurities in the noble metals. Recently, improved accuracy and consistency in the measurements of nickel in lead have demonstrated a marked concentration dependence even in the range of a few parts per million. This work will be continued to study the behavior of cadmium in lead and of a series of fast diffusers in single crystal tin. The electromigration of hydrogen in copper will also be investigated. A third project will try to understand forced motion effects in Met-Glass systems, especially in the high-temperature range.

First year of a 2-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0039, LEED CRYSTALLOGRAPHY AND SURFACE RECONSTRUCTION
F. Jona, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (DMR77-27933)

Experimental studies of atomic structures on single crystal surfaces using low-energy electron diffraction (LEED) which previously were funded by NSF grant DMR-7203294 will be continued. This research will be concentrated in three areas: (1) The problem of structural reconstruction on semiconductor surfaces. This effort will include work on the structure of Ge(001)2x1 and Si(001)2x1, as well as studies of metallic adsorbates on both the (001) and the (111) surfaces of of Si and Ge. (2) The problem of molecular adsorption and structural reconstruction on metal surfaces. This effort will involve reexamination of the low-temperature reconstruction on W(001) and Mo(001), and resumption of analyses of the ordered chemisorbed layers of CO and O on Mo(001). (3) The investigation of search procedures for the rapid identification of probable and improbable models in LEED crystallography.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0040, HIGH RESOLUTION RF SPECTROSCOPY OF ATOMS AND IONS
H.G. Robinson, Duke University, Trinity College of Arts & Sciences, Dept. of Physics, *Durham, North Carolina* 27706 (PHY77-22567)

Research will continue to determine gJ(4He ion, 1 2s1/2) relative to gJ(1H, 1 2S1/2) or gJ(Electron) to a precision of between 1 and 5 parts in 10 to the 8th power. The precision determination of gJ(4He, 2 3S1) / gJ(1H, 1 2S1/2) will be continued and concluded with the goal of reducing systematic effects so that advantage can be taken of the exceptionally narrow (220Hz) linewidth achieved for the helium metastable Zeeman resonance. In addition, an experiment is to be initiated to determine the fine and hyperfine structure of the 3 3P state of helium. Motivation is provided through comparison with the theory of these fundamentals one and two electron systems. Finally, toward an understanding of collision processes in helium-

alkali cells, Penning ionization cross-sections will be determined for Rb, Cs, and K colliding with 4He, 2 3S1.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0041, SPACE CHARGE AND ELECTRODE REACTION EFFECTS IN SOLIDS AND LIQUIDS

J.R. MacDonald, University of North Carolina, Chapel Hill Campus, School of Arts & Sciences, Dept. of Physics, *Chapel Hill, North Carolina* 27514 (DMR76-84187 A01)

This work is concerned with the electrical behavior of systems in which a nonmetallic solid or liquid is in contact with metal electrodes. Greater understanding of such systems is desirable both for its intrinsic scientific value and for its technological applications, notably in the area of energy conversion and storage. The primary goal is to relate electrical responses observable in the laboratory (transient and steady-state AC and DC response) to the parameters which characterize the behavior of the system on a microscopic level.

The research includes the following: The exact small signal AC response is being determined for a somewhat more general microscopic model than treated previously, representing a wider variety of systems. The exact response will be cast into simplified forms for easier comparison with experiment. The transient and steady-state AC and DC response of a selected group of systems will be determined by computer simulation. Modifications will be made in the basic microscopic equations to better represent materials, such as superionic conductors, in which the motions of individual mobile charges are strongly coupled with each other.

Continuation of work supported under DMR-75-10739. Three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0042, LOW TEMPERATURE TRANSPORT PHENOMENA IN METALS

J.C. Garland, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave., Columbus, Ohio* 43210 (DMR78-09428)

Experimental studies of thermoelectricity in superconducting metals and of the strong field galvanomagnetic properties of inhomogenous metals previously supported by NSF grant DMR-7611633 will be continued. The low temperature transport studies will be concentrated in two problem areas. The first of these will include measurements of thermoelectricity in pure superconductors by a technique developed earlier in which magnetic flux is generated within a toroidal cavity. This is an extension of previous research which identified a thermoelectric effect unique to the superconducting state. The second problem area is concerned with the effect of inhomogeneities on electron transport in metals under the influence of strong magnetic fields. The experiments will be concentrated on materials consisting of superconducting grains imbedded in a normal metal medium.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0043, ISOSPIN AND GIANT-RESONANCE EFFECTS IN NEUTRON SCATTERING AND NEUTRON-INDUCED CHARGED-PARTICLE REACTIONS

J. Rapaport, Ohio University, Athens Campus, School of Arts & Sciences, Dept. of Physics, *Athens, Ohio* 45701 (PHY78-09911)

This grant will support a program of basic research in nuclear physics. An 11-meV high intensity pulsed Tandem Van de Graaff accelerator produces mono-energetic neutrons which are being used to carry out studies of neutron-nucleus interactions. Studies of isospin and giant-resonance effects in neutron scattering will be carried out. An entirely new technique to study neutron-induced charged-particle reactions with previously unavailable and flexibility will be further developed.

Giant resonance effects will be studied using high-energy neutrons as probes. Studies of inelastic scattering from several targets will be done in order to see directly these giant states, or as in the case of Carbon-12, to answer other basic questions such as isospin mixing. Measurement of the excitation functions of excited states in isospin equals 0 nuclei will be carried out with high energy neutrons to study the influence of these giant states on the scattering to lower states.

A new facility capable of a broad range of neutron induced charged-particle reaction studies will be developed. Important questions of basic physics as well as important applications will also be pursued.

This is a continuation of work supported under NSF grant PHY76-11450 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0044, THE PHYSICS OF FLUIDS

R.J. Donnelly, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (DMR78-10782)

This is a continuation of work sponsored under DMR-7621814.

Research on the hydrodynamics and thermodynamics of helium-II will be continued. Measurements will be made of quantum fluid turbulence to determine the mean and fluctuating parts of the vortex line density in a counterflow of normal and superfluid components. Equations of motion are being sought which contain all the realistic properties of the system, such as quantized vortices, healing and relaxation effects. A consistent data base for the thermodynamic properties of helium-II and mixtures of helium-3 and helium-4 will be generated. The results of this work are significant for the cooling of superconducting devices.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0045, THEORY OF ELECTRON SPIN POLARIZATION IN PHOTOEMISSION

P.H. Cutler, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DMR77-09934)

A theoretical study will be carried out on electron spin polarized (ESP) emission as a fundamental new probe of magnetic solids; specific applications will be made to the investigation of surface and bulk electronic properties of 3-D-ferromagnetic metals. The project comprises the following three interrelated studies: a. A transfer Hamiltonian formulation for field emission of polarized electrons, including band structure, correlation and spin dependent surface interactions; b. A new many-body formulation of spin polarized tunneling and field emission; c. A theoretical investigation of matrix element effects on the ESP of photoemitted electrons from ferromagnetic 3-D-transition metals.

The purpose of the study is (1) to clarify the relation between the measured ESP and the bulk spin polarization; (2) to determine whether, and for what reason, the ESP measurements of photo- and field-emitted electrons complement or contradict each other; (3) to determine the adequacy of the itinerant model of ferromagnetism in the transition metals, and possible extension of the model suggested by field- and photoemission ESP experiments; (4) to determine the importance of many-body effects beyond the mean (exchange) field in the ESP field- and photoemitted electrons, using both established and new techniques.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0046, SMALL ANGLE NEUTRON SCATTERING FROM FERROFLUIDS
A.C. Nunes, University of Rhode Island, School of Arts & Sciences, Dept. of Physics, *Kingston, Rhode Island* 02881 (DMR78-03024)

A ferrofluid (a collodial suspension of magnetic particles) is a magnetic fluid which has unique applications in rotating seals and particle separators. As a collection of subdomain sized particles a ferrofluid is a physically interesting magnetic system, a superparamagnet, whose properties are presumably dominated by surface phenomena, because of their relatively large surface to volume ratio. Several measurements of ferrofluids have demonstrated magnetic properties significantly different from the bulk materials. Most of these techniques measure volume averages however, and there is little direct information of the magnetic structure of the particles themselves. A polarized neutron small angle scattering investigation of a ferrofluid will be undertaken to ascertain the chemical makeup and magnetic structure of a colloidal ferrite suspended in water. This will be the first application of small angle neutron scattering to such a system. Results will be compared with model predictions. Experience gained in this work may also have technological ramifications in the field of polarized neutron scattering as a polarizing filter.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0047, VIBRATIONAL POTENTIAL FUNCTIONS FOR SMALL MOLECULES
R.W. Redding, North Texas State University, School of Arts & Sciences, Dept. of Physics, *N. Texas Station, Box 13707, Denton, Texas* 76203 (B-516)

We have succeeded in the first phase of our calculation regarding the Eckart frame for non-linear molecules. Our primary interest is in correlating the symmetry of molecular vibrations with motions of this reference frame, which is important in achieving simplification of the vibration-rotation Hamiltonian. The work so far has been directed toward understanding the contributions that the various symmetry species of the molecule's point group make in causing movement of the frame. Our approach is patterned after perturbation theory, and yields good results. In particular, we are able to pick out on the basis of their symmetry those vibrations which cause no changes in the Eckart frame, regardless of their amplitude. This work is continuing.

Our work on the avoided crossing problem in diatomic molecules has continued. We are currrently applying a new technique that we previously developed for calculating the parabolic cylinder functions, which are key components in the ultimate application of our overall method to experimental data. Our recent calculations give good indication that this new method provides the necessary accuracy, unavailable until now.

SUPPORTED BY Robert A. Welch Foundation

8.0048, COLLISIONS INVOLVING ATOMS IN HIGH RYDBERG STATES
R.F. Stebbings, Rice University, Graduate School, Dept. of Physics, *6100 Main St., Houston, Texas* 77001 (PHY78-09860)

Research will continue on the structure and properties of very highly excited ('Rydberg') atoms. Topics to be pursued include: 1. Thermal collisions with atoms and molecules; 2. Collisions with low-energy electrons; 3. Field ionization; 4. Production of Rydberg atoms; 5. Excitation transfer; 6. Chemiionization.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0049, THE ROLE OF GRAVITATION IN PHYSICS
B.S. DeWitt, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (PHY77-22489)

Research initiated on NSF grant PHY74-03563 A03 will continue on the role of gravitation in physics, at the quantum level and in the realm of astrophysics. The specific problems to be undertaken are: 1. Computer calculations of (a) collapsing spherical and nonspherical, rotating and nonrotating distributions of matter, (b) the formation of black holes, and (c) the gravitation radiation emitted. Standard polytropic equations of state will be used. The computer will also be used to study maximal slicings of the Kerr geometry. 2. A study of the vacuum stress (vacuum polarization) in strong gravitational fields, in accelerating frames, and in regions with curved boundaries. 3. Further study of quantum field theory in curved spacetime. 4. Differential geometry, Lie group theory and fiber-bundle theory on Z-graded algebras. 5. Further development of quantum theories of gravity and supergravity. 6. Topics in classical relativity.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0050, THE METAL-NONMETAL TRANSITION IN LIQUID MIXTURES
J.C. Thompson, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR7821744)

The metallic state in disordered materials, both liquids and solids, can not be understood on the basis of present theories for crystalline systems. To reach an understanding of these systems, the metal-nonmetal transition must be understood. This is the goal of the present work.

Systems of present interest are solutions of an alkali metal in liquid ammonia, and liquid alloys of Group IIIA Metals with such chalcogens as tellurium. Four techniques are used: optical reflectance from 0.5 to 5.0 eV; conductivity and (electrodeless) Hall coefficient measurements; photoconductivity; and field effect. The last two are new methods for liquids. Densities of electron states as well as carrier densities, mobilities and lifetimes are determined as functions of composition and temperature. These are interpreted in terms of disorder, electron-electron interaction, structural defects, and chemical bonding.

This is a continuation of work supported by DMR76-84338. It is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0051, ATOMIC AND MOLECULAR PHYSICS
C.B. Collins, University of Texas, Dallas Campus, School of Natural Science & Mathematics, Dept. of Physics, *P.O. Box 688, Richardson, Texas* 75080 (INT76-18982)

To date, this project has introduced the concept of hybrid resonances in multiphoton spectroscopy, demonstrated a technique suited for the examination of diffuse molecular bands, and pointed a direction toward discovery, identification and analysis of repulsive and weakly bound states of alkali molecules. In the forthcoming period, work will be directed to quantitative studies significant to broad areas of plasma chemistry, laser physics, and aeronomy, and specifically to applied physics efforts in e-beam lasers and photochemistry. Structure and properties of repulsive states of alkali-bearing molecules will be defined, primarily by multiphoton spectroscopy. The order of occurrence of repulsive states of cesium, not expected in earlier theory, will be further delineated by examination of the dissociative part of the cesium spectrum. The work will be extended to rubidium, and subsequently applied to cesium and rubidium combinations with inert gases in order to obtain comprehensive spectroscopic data on the excimer states of these alkali-inert gas molecules. Finally, collisional effects will be studied by variation of the time delay between laser excitation of molecular transition and laser detection of the dissociation fragments.

This work will be conducted in cooperation with Iovitzu Popescu, et al., Institute of Physics, Bucharest, Romania. Experimental work on cesium will produce quantitative values of line strengths and potential curves for comparison with developing theory. The evolving theory itself is mainly a Romanian contribution, and will be numerically evaluated on U.S. comput-

ers. Application will then be directed to fine structure effects and subsequently extended to additional alkali systems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0052, NONEQUILIBRIUM SUPERCONDUCTIVITY
J.L. Paterson, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR74-23661 A01)

These studies are important for delineating the basic properties of nonequilibrium superconductivity and for understanding the behavior of the devices derived from thin-film junctions.

Studies of nonequilibrium superconductivity will be made by means of thin-film, double tunnel junctions. The quasiparticle energy distribution will be measured as the degree of nonequilibrium increases. Elastic and inelastic branch-mixing times and inelastic scattering times will be determined in the weakly-perturbed regime. Explanations for the first order phase transition and two energy gaps in the center film in the strongly-perturbed regime will be sought.

This is a continuation of research supported under DMR74-23661.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0053, ELEMENTARY PARTICLE THEORY
V.L. Teplitz, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Physics, *Blacksburg, Virginia* 24061 (PHY78-08436)

The proposed work is in the field of theoretical physics, emphasizing study of the interactions among elementary particles. Specific problems to be examined include: a) Continuation of the unitary pi N yields pi pi N isobar analysis; b) Extension of the results in A to pi N elastic scattering and pi pi N threshold (current algebra) analysis; c) study of M1 transitions using the MIT bag model; d) application of astrophysics to weak interaction phenomenology.

This work is a continuation of that currently supported under NSF grant PHY-7611349A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0054, SINGLE ATOMIC PARTICLES AT REST IN SPACE
H.G. Dehmelt, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (PHY78-08562)

This is an experimental research program in fundamental physics. By means of novel techniques for storing and studying simple atomic particles, measurements will continue of the magnetic moment anomalies-of the electron and the positron to reach an accuracy comparable to that now routinely achieved in high-resolution proton NMR studies (i.e., one part in ten billion) for a precision test of particle-antiparticle symmetry. These measurements will be the most precise determination of the structure of elementary particles.

This is a continuation of work currently supported by NSF Grant PHY76-11176 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0055, GALACTIC ELECTRONS, ENERGY SPECTRUM OVER 300 GEV
J.J. Lord, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (INT78-06972)

This award will support Professor Jere J. Lord of the University of Washington in Seattle over a period of two years in a program of cooperative instrumented balloon flights with Professor Jun Nishimura of the Institute of Space and Aeronautical Science, University of Tokyo, for the purpose of studying cosmic radiation at ultra-high energies. Professor Lord and another member of his research group will travel to Tokyo for coordination and training in preparation for several research balloon launches from Palestine, Texas, and for final analysis of data, utilizing experimental facilities at the University of Tokyo.

The project will utilize emulsion chamber detection techniques to study the high-energy portion of the primary cosmic ray electron spectrum, one of the important problems in astrophysics where improved data is necessary to determine the origin of the electron component. The results derived from this research will have an important bearing on the origin of cosmic rays and their propagation through the galaxy. The joint efforts of the U.S. and Japanese research groups in the design, fabrication, and operation of the balloon instruments and in the subsequent analysis of data will make possible the performance of reliable measurements in a program too large to be handled by a single research group.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0056, STATISTICAL MECHANICS OF SIMPLE SYSTEMS
L.W. Bruch, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Physics, *Agriculture Hall, Madison, Wisconsin* 53706 (DMR78-09429)

Research previously supported by DMR74-19826.

Research in condensed matter physics on the theory of inert gas systems, especially under the conditions of physical adsorption, will be carried out. The goals of the program are: (1) clarification of the forces which act in physical adsorption and (2) the development of statistical mechanical theories of the inert gases in dense phases, including helium at low temperatures where there are large quantum mechanical effects. The research includes: semi-empirical analysis of experimental data to identify the dominant interaction mechanisms for adsorbed krypton and xenon; the study of continuum approximations for the adsorbing surface with idealized models; and variational calculations of the ground state energy of weakly bound systems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, PITCH ANGLE DISTRIBUTIONS OF THERMAL IONS IN THE INNER THERMOSPHERE
J.L. Horwitz, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Physics, *Huntsville, Alabama* 35807 (NSG 5413)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0002, ANTARCTIC ATMOSPHERIC INFRASOUND
C.R. Wilson, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (DPP77-22997)

Observations of auroral infrasonic waves (AIW) will be carried out at Windless Bight near McMurdo Station, Antarctica, during 1979, using a four-microphone array. Data from the microphone array will be collected at a central point and telemetered to Scott Base where it will be recorded in digital form on chart recorders and on slow-speed magnetic tape.

During the second year of this grant, the AIW data, along with riometer, magnetometer, and all-sky camera data collected at Scott Base, will be used to investigate how auroral infrasonic waves are generated.

Logistics support is required for one person at McMurdo during the austral summer of 1979/80.

Previous award number is DPP-7305897 A03 (Proposal Number DPP-7719091).

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

10.0003, STUDY OF MAGNETOPAUSE/BOUNDARY LAYER AND PLASMA SHEET STRUCTURES
L.C. Lee, University of Alaska, Fairbanks Campus, Graduate School, *Fairbanks, Alaska* 99701 (NSG 5409)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0004, THEORETICAL STUDIES OF INTERPLANETARY MAGNETIC FIELDS, TURBULENCE AND COSMIC RAYS
E.H. Levy, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (ATM76-17058 A01)

A significant part of the sun's influence on the earth and the planets is exerted through the intermediary of the solar wind. In addition, our general ideas about the behavior of astrophysical plasmas can be directly tested only in interplanetary space. For these reasons solar-wind studies have relevance over wide areas of science.

The grant continues support for theoretical studies of a range of basic solar-wind properties and behaviors. In this continuing program, the investigations undertaken will include the effects of turbulence influctuations on measured radial variations of, for example, solar-wind density, the interplanetary magnetic field and the density of cosmic rays. Also the large-scale morphology of the interplanetary magnetic field will be studied, with particular emphasis given to the effect of the field's structure on cosmic-ray propagation and anisotropies. Scintillations in the flux of astronomical radio waves are produced by turbulence and fluctuations in the solar-wind. This has opened an avenue for ground-based studies of solar-wind variations. Since the theory of these scintillations is still incomplete, research into the causes of radio scintillations will be undertaken.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0005, STUDIES IN STELLAR ASTRONOMY
J. Greenstein, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST77-09191)

The properties of intrinsically faint stars have been under study by the principal investigator for many years. A large amount of observational material is already available as a result of observing programs carried out on the 200-inch Hale reflector on Mt. Palomar. Statistical and astrophysical studies of these observations will be made in order to determine the spatial distribution and kinematics of these stars in our Galaxy and the solar neighborhood. Physical characteristics, such as temperatures and composition differences, will also be determined. This program will provide new data on low-mass stars which will be of use in studies of stellar and galactic evolution.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, SPECTROSCOPIC OBSERVATIONS OF QUASARS
M. Schmidt, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST77-22615)

The following research programs will be carried out: 1) A continuing search for, and measurement of the spectroscopic studies of bright quasars, 2) The obtaining of spectra and red shifts of faint quasars, 3) A study of the optical continuum of quasars, and 4) Other incidental studies of radio quasars. The studies of bright and faint quasars will yield information on the exact shape of the very steep decrease of quasar space density with cosmic time. The study of the optical continuum, which already has uncovered a wavelike deviation from a power law, may lead to improved understanding of the radiation mechanism at work in the generation of the extraordinary luminosity exhibited by quasars. Spectroscopic studies of radio quasars are designed to improve our knowledge of the radio luminosity function of quasars.

This is a continuation of research done under grant AST 75-22923 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0007, HIGH-RESOLUTION INTERFEROMETRY OF SOLAR RADIO SOURCES
H. Zirin, California Inst. of Technology, Graduate School, Dept. of Astrophysics, *1201 E. California Blvd., Pasadena, California* 91109 (ATM76-80782 A01)

This grant continues a program of high-resolution interferometry of the quiet and active sun at the Owens Valley Radio Observatory, California. Solar bursts will be measured at 2.8 cm with 1 sec time resolution, 4 arc sec one-dimensional resolution and compared with simultaneous optical data. Equipment to reduce the time constant to 0.1 sec and to keep bursts from saturation will be developed. Data already accumulated will be further analyzed. A program of observations at the Very Large Array (VLA) will be carried out.

The work should result in new understanding of the size and intensity distribution in solar flare bursts, the height of the energetic source, and the relation of the polarization to magnetic field structure. The quiet sun work will give new data on temperature fluctuations in the chromospheric network.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0008, DETERMINATION OF INTERSTELLAR ABUNDANCES BY CORRELATED X-RAY AND ULTRAVIOLET OBSERVATIONS
A.B. Walker, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (NSG 5417)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0009, APPLICATION OF IMPROVED DETECTOR TECHNOLOGY TO A CONTINUING PROGRAM OF SOLAR-SYSTEM OBSERVATIONS
A.L. Broadfoot, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 7644)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Space Science

10.0010, OPTICAL OBSERVATIONS OF CELESTIAL X-RAY SOURCES
B. Margone, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (AST77-27745)

A research program to study several characteristics of galactic and extragalactic X-ray sources will be carried out using the latest ground-based spectrophotometric, photometric, and photographic techniques. A major portion of the effort will be devoted to discovering visible or near-infrared counterparts of galactic X-ray binary stars by using the very accurate X-ray positions available from recent satellite experiments. The objects so identified, plus a number of already known identifications, will be observed spectroscopically to help understand the effects of the nearby X-ray source on the structure and evolution of the

relatively normal companion star. Results of this research will bear directly on several problems on the late stages of stellar evolution. Because most X-ray sources are thought to involve a collapsed object, such as a neutron star or black hole, these data will provide insights which are impossible to gain in the laboratory concerning the physics of these very unusual stars.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0011, OBSERVATIONS OF THE SUN, ALPHA CENTAURI AND CLUSTER STARS
D.C. Barry, University of Southern California, School of Letters Arts & Sciences, Dept. of Astronomy, *3551 University Ave., Los Angeles, California* 90007 (NSG 5412)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0012, A COMPARATIVE STUDY OF THE FAR ULTRAVIOLET SPECTRA OF BE STARS
G.J. Peters, University of Southern California, School of Letters Arts & Sciences, Dept. of Astronomy, *3551 University Ave., Los Angeles, California* 90007 (NSG 5422)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0013, THEORETICAL ASTROPHYSICS RESEARCH
R. McCray, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *1200 University Ave., Boulder, Colorado* 80302 (AST78-06714)

Theoretical problems concerning the interstellar medium will be studied. These include: 1) the maintenance and stability of a hot (T approximately 10 to the 6th power degrees K) phase of the gas that results from supernova blasts; 2) the effects of precursor ionization by high velocity shocks propagating in neutral atomic hydrogen (HI) regions; 3) the characteristics of time-dependent molecular hydrogen (H2) dissociation fronts.

A broad program for studying cosmic X-ray sources will be continued. Various problems having to do with the transfer of X-rays through the gas distribution around the source and the associated gas dynamical response will be investigated. A major goal is to predict the optical, ultraviolet, and X-ray spectral response of various idealized gas distributions in order to provide a framework for initiating and interpreting observations of such spectra with ground-based and space observatories. The particular systems to be studied include: 1) Stellar atmospheres illuminated by a companion X-ray source; 2) X-ray sources embedded in stellar winds from a binary companion; 3) Optically thick distributions of gas surrounding the magnetosphere of a neutron star X-ray source; 4) Models for Seyfert galaxies and quasars involving accretion by a supermassive black hole.

This is a continuation of research done under AST 75-24590 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0014, HIGH RESOLUTION SPECTROPHOTOMETRIC OBSERVATIONS OF INTERSTELLAR ABSORPTION LINES
T.P. Snow, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (NSG 7626)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0015, OBSERVATIONS OF MASS LOSS FROM HD-193793 AND OTHER WOLF-RAYET STARS
S.T. Gottesman, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Astronomy, *208 Tigert Hall, Gainesville, Florida* 32601 (AST78-01278)

Wolf-Rayet stars are hot, luminous stars with expanding atmospheres. Material is being ejected from them as a stellar wind at a rate of at least a billion times that of the sun. The structure, the physical cause for the high mass loss rates, and the evolutionary history of these stars are not understood. This project will be concerned with radio observations of Wolf-Rayet stars, and in particular one known as HD-193739. A large change has occurred in the stellar wind of HD 193793. By observing radio waves from the tenuous, outer regions of its stellar wind this disturbance can be studied. Variations in the rate of mass ejection, and the expansion velocity of the stellar wind will be determined.

In addition to HD 193793, only two other radio emitting Wolf-Rayet stars are known. The Very Large Array in New Mexico and the Green Bank radio interferometer in West Virginia will be used to search for radio emissions from other Wolf-Rayet stars.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0016, THE PHYSICAL PROPERTIES AND EVOLUTION OF GALACTIC NEBULAR COMPLEXES
H.R. Dickel, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST77-21021)

The study of molecules in galactic nebular complexes has led to physical models of the structure and dynamics of these molecular clouds. There is observational evidence for fragmentation, systematic motions, and an evolutionary progression within these clouds. The regions to be studied will include ionized hydrogen (HII) region-molecular cloud complexes. The dynamics of these clouds will be explored in the context of possible processes of star formation, the evolutionary development of prostellar envelopes and the transfer of the radiation in the molecular lines. Models which can (or cannot) explain an all-pervasive broad-wing feature in the line profiles we have observed in the DR21-W75 area will be investigated. The self-absorption interpretation of our observed 12CO profiles toward W3 will be further examined by comparing our observations of other molecules, such as 13CO, C18O, HCN, CS, and H2CO (at 6 cm. and 2 mm.), with their behavior predicted from the model-calculations. The possibility of self-absorption of the 12CO emission toward NGC 7538 will be studied. The investigation of the apparent correlation of molecular line width delta V with temperature TB found for a limited number of sources will be continued.

This is a continuation of research done under grant AST 75-2208 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0017, FUNDAMENTAL STUDIES IN THEORETICAL X-RAY ASTRONOMY
D.Q. Lamb, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (NSG 7653)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0018, INFRARED STUDIES RELEVANT TO A SATELLITE OF PLANET JUPITER
R.K. Khanna, University of Maryland, College Park Campus, Graduate School, Dept. of Chemistry, *College Park, Maryland* 20742 (NSG 5424)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0019, SOLAR MAXIMUM MISSION - GROUND SUPPORT PROGRAMS AT THE HARVARD RADIO ASTRONOMY STATION
A. Maxwell, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NSG 7648)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0020, EXPERIMENTAL AND THEORETICAL INVESTIGATIONS IN HIGH ENERGY ASTROPHYSICS
G.W. Clark, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 7643)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0021, GROUPS OF GALAXIES
J.R. Gott, Princeton University, Graduate School, Dept. of Astrophysical Science, *205 Nassau Hall, Princeton, New Jersey* 08540 (AST7624481 A01)

Most galaxies in the universe including our own are members of small groups. A systematic study of groups of galaxies has been started by developing a computer algorithm for identifying small groups as surface density enhancements in the sky (Turner and Gott). In collaboration with S. Aarseth in England, several 1000-body and 4000-body dynamical simulations of galaxy clustering in an expanding universe have been made. The simulations can then be observed and catalogues made of groups of galaxies just as is done for the observations. So far the results have been quite promising. Galaxy pair separations in the simulations are nearly identical to those observed and groups of galaxies in the simulations compare well with observed groups. Computer runs representing both open and closed cosmologies having a variety of initial conditions have been made. By analyzing these simulations, it is hoped to learn more about the masses of galaxies, the formation and properties of groups, and to provide clearer tests of whether the universe is open or closed.

This is a continuation of work done under grant AST 76-24481.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0022, STUDIES OF DEGENERATE STARS
H.M. Van Horn, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (AST76-80203 A01)

This work will be concerned with three main areas of research on degenerate stars: 1) There will be a study of the atmospheres and the internal structure and evolution of white dwarf stars. The non-radial oscillations and emission of gravitational radiation will be examined. 2) The properties of neutron stars will be studied. In particular there will be an investigation of the structure and evolution of cooling neutron stars and of neutron stars undergoing accretion. The non-radial oscillations and gravitational wave radiation of these objects will also be studied. 3) There will be a continuation of work on a computer program to permit the calculation of self-consistent, quasi-static models of the evolution of rotating stars. There will also be some research on magnetic field evolution in degenerate stars.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0023, A STUDY OF STELLAR SURFACE PHENOMENA
B.W. Bopp, University of Toledo, School of Arts & Sciences, Dept. of Physics & Astronomy, *2801 W. Bancroft St., Toledo, Ohio* 43606 (AST77-09450)

Surface phenomena on our Sun have a variety of forms. Flares, plages, faculae and prominence activity are all localized phenomena, occupying only a small fraction of the solar disc. If we assume our Sun to be a typical star, then obviously other stars must exhibit surface phenomena also. However, for stellar flare activity to be detected, either the level of activity must be considerable higher than that of the Sun, or the background light from the undisturbed stellar photosphere must be low.

This investigation will be a comprehensive examination of stellar surface phenomena, with the objective of obtaining detailed information on the lifetime, development, location, and geometry of stellar active regions. The chromospheric emission lines and the stellar continuum in many stars with a high degree of surface activity will be monitored. In some cases, these observations will be coordinated with far-ultraviolet satellite observations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0024, LONG-RANGE ANTINEUTRINO BURST DETECTOR
K.E. Lande, University of Pennsylvania, School of Arts & Sciences, Dept. of Astronomy, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (AST76-17786 A01)

This research grant provides support for completion of construction and initial operation of a five hundred cubic meter neutrino and antineutrino burst detector situated in the Homestake Gold Mine in Lead, South Dakota. The detector will consist of ninety-six water Cerenkov counter modules and eighty liquid scintillation counters and will look for: 1) neutrinos and antineutrinos from collapsing stars in our galaxy; 2) high-energy neutrinos from localized extraterrestrial sources such as young pulsars; 3) oscillations of neutrinos produced by cosmic ray primaries in the Earth's atmosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0025, OBSERVATIONS OF SPECTRUM VARIABILITY OF HOT PECULIAR A STARS
S.J. Adelman, Citadel Military College of South Carolina, Graduate School, Dept. of Physics, *Charleston, South Carolina* 29409 (NSG 5420)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0026, INVESTIGATION OF MASS FLOW IN STELLAR ATMOSPHERES
J.L. Modisette, Houston Baptist University, School of Science & Health Professions, Dept. of Physics, *7502 Fondren Rd., Houston, Texas* 77036 (NSG 5421)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0027, THEORETICAL STUDY OF PLASMA FLOW INTERACTIONS WITH PLANETS
P.A. Cloutier, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (ATM77-12955 A01)

This grant will support theoretical research on the interaction of flowing plasmas with planetary bodies in continuation of the investigations conducted under previous NSF Grants GA 28033x and DES 74-19668. Work to date under these grants has been directed at an understanding of solar-wind interactions with the atmospheres and ionospheres of non-magnetic or weakly magnetic planets such as Venus and Mars, and has led to formulation of models which appear to explain the general features of the flow of solar wind plasma in the vicinity of these planets. However, a more detailed study will be undertaken to allow predictions of localized atmospheric profiles and structures, including effects of asymmetries in flow patterns, vari-

ations in atmospheric parameters with time and geographic location, and especially the effects of photochemistry, diffusion, and thermalization. The major aims of this work are to produce a quantitative model relevant to and an understanding of the PVO physical mechanisms concerning the interaction of the solar wind with planetary atmospheres.

SUPPORTED BY U.S. National Science Foundation,
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of Atmospheric Sciences

10.0028, THE MARTIAN CARTOGRAPHIC COORDINATES AND THE ROTATIONAL ELEMENTS OF MARS

G.H. De Vaucouleurs, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST76-81090 A01)

The ephemeris for physical observations of Mars, in the national ephemerides, is based on the coordinates of the north pole of Mars, its rotational period, and the value for the longitude of the central meridian at a selected epoch. Extensive new data from radar observations and by direct imaging from spacecraft have made accurate cartography of the Martian surface possible. To use this as a basis for the physical ephemeris of Mars, it is essential to relate the new cartographic coordinates rigorously to the rotational elements.

The International Astronomical Union has recommended a new set of physical elements of Mars be adopted and a new physical ephemeris of Mars based on these elements be published when two critical unknowns have been determined: 1) An improved value for the rotation period of Mars from the past 3 centuries of observations, and 2) The relation between the traditional system of areographic coordinates and the new system adopted for the Mariner 9 cartographic results.

This investigation will complete the analysis of central meridian transits and areographic longitude data for the period 1877-1971 and extend it to the period 1659-1875, to derive a definitive value for the rotation period of Mars, also make detailed comparisons between the coordinates of surface features from telescopic observations and from Mariner 6, 7, and 9 to establish the zero-point differences between the old and new systems.

SUPPORTED BY U.S. National Science Foundation,
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Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0029, THE CHEMICAL COMPOSITION OF STARS

D.L. Lambert, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (F-634)

Chemical elements beyond carbon are synthesized by nuclear reactions in the hot interior of stars. Through convective mixing, newly synthesized elements may be brought to the spectroscopically accessible surface. Experimental tests of element synthesis-mixing theories have been performed using high resolution low noise stellar spectra obtained at the W.J. McDonald Observatory.

Emphasis has been placed on several kinds of stars whose spectra suggest an anomalous chemical composition. A detailed analysis of a cool star with unusually weak lines of the CH molecule revealed that the atmosphere was severely contaminated with the products of the nuclear reaction network known as the CN bi-cycle. The spectrosopic evidence includes a low ratio of C to N and the ratio 12C/13C equals 4 which is equal to the predicted equilibrium ratio for the CN bi-cycle. It is proposed that such rare stars were mixed by meridional circulation induced by rapid rotation.

Analysis of profiles of MgH A2pi-X2zeta lines in the spectra of classical Barium stars show that the isotopic abundance ratios 24Mg/25Mg are terrestrial. Severe enhancements in the concentrations of heavy elements are attributed to irradiation by slow neutrons. The Mg isotope analysis shows that the neutron source is not 22Ne(alpha,n)25Mg but 13C(alpha,n)16O.

SUPPORTED BY Robert A. Welch Foundation

10.0030, EVOLUTION AND DYNAMICS OF EXPLODING STARS

J.C. Wheeler, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST76-07629 A01)

This research will be devoted to a study of the final phases of the evolution of a star. The collapse of the interior of a star will be investigated. The subsequent supernova explosion, if it occurs, and the effects of neutrino degeneracy and general relativity will be examined. The late stages of evolution of intermediate mass stars will be investigated. There will also be a study of the effects of supernovae explosions in the depths of dense molecular clouds.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Astronomical Sciences

10.0031, SPECTROSCOPY AND THEORY OF HERBIG-HARO OBJECTS AND OF ATMOSPHERES OF WHITE DWARF STARS

K. Bohm, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (AST76-22262 A01)

The research to be carried out will involve the very early and the very late stages of stellar evolution. Research on the very early stages of stellar evolution will be concerned with a study of the properties of the Herbig-Haro objects. These are objects which are believed to be stars in the very early stages of evolution. All known objects of this type are found within the boundaries of dark clouds. There will be a study of the spectra, the lifetimes, the geometrical size and the chemical abundances of these objects.

White dwarf stars, which represents a very late stage in the evolution of a star will be studied. Theoretical calculations on the atmospheres and envelopes of these stars will be made, and the effects of energy transfer in the atmospheres of the very cool white dwarf stars to be examined. The possible formation of a corona around white dwarf stars and the consequences of this theory on predictions of the soft X-ray and extreme ultraviolet fluxes emitted by these stars will be determined.

This is a continuation of work previously supported by NSF grant AST76-22262.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-26284*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED AIRSPEED CALIBRATION DATA FOR A SINGLE-ENGINE RESEARCH-SUPPORT AIRCRAFT
Bruce J. Holmes Jun. 1980 22 p refs
(NASA-TM-81832) Avail: NTIS HC A02/MF A01 CSCL 01D

A standard service airspeed system on a single engine research support airplane was calibrated by the trailing anemometer method. The effects of flaps, power, sideslip, and lag were evaluated. The factory supplied airspeed calibrations were not sufficiently accurate for high accuracy flight research applications. The trailing anemometer airspeed calibration was conducted to provide the capability to use the research support airplane to perform pace aircraft airspeed calibrations. Author

N80-26285# Transportation Research Board, Washington, D.C.
AVIATION FORECASTING, PLANNING, AND OPERATIONS
David E. Raphael, Adib Kanafani, Redha Behbehani, Huey-Shin Yuan, and Sergio Zuniga 1979 86 p refs
(PB80-154354; TRB/TRR-732; LC-80-11905; ISBN-0-039-02987-2; ISSN-0361-1981) Avail: NTIS HC A05/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 05C

The overall business environment in aviation, markets and prices, completion and regulation, and operations and technology are addressed. Major emphasis is placed on the following: aviation forecast assumptions and discontinuities; forecasting airport traffic; and airport planning. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N80-26286*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPUTER PROGRAM TO GENERATE TWO-DIMENSIONAL GRIDS ABOUT AIRFOILS AND OTHER SHAPES BY THE USE OF POISSON'S EQUATION
Reese L. Sorenson May 1980 62 p refs
(NASA-TM-81198; A-8178) Avail: NTIS HC A04/MF A01 CSCL 01A

A method for generating two dimensional finite difference grids about airfoils and other shapes by the use of the Poisson differential equation is developed. The inhomogeneous terms are automatically chosen such that two important effects are imposed on the grid at both the inner and outer boundaries. The first effect is control of the spacing between mesh points along mesh lines intersecting the boundaries. The second effect is control of the angles with which mesh lines intersect the boundaries. A FORTRAN computer program has been written to use this method. A description of the program, a discussion of the control parameters, and a set of sample cases are included. E.D.K.

N80-26287*# Boeing Vertol Co., Philadelphia, Pa.
DESIGN AND ANALYTICAL STUDY OF A ROTOR AIRFOIL Final Report
L. U. Dadone May 1978 93 p refs
(Contract NAS1-14659)
(NASA-CR-2988; D210-11239-1) Avail: NTIS HC A05/MF A01 CSCL 01A

An airfoil section for use on helicopter rotor blades was defined and analyzed by means of potential flow/boundary layer interaction and viscous transonic flow methods to meet as closely as possible a set of advanced airfoil design objectives. The design efforts showed that the first priority objectives, including selected low speed pitching moment, maximum lift and drag divergence requirements can be met, though marginally. The maximum lift requirement at M = 0.5 and most of the profile drag objectives cannot be met without some compromise of at least one of the higher order priorities. Author

N80-26288*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.
A COMPUTER PROGRAM FOR CALCULATING AERODYNAMIC CHARACTERISTICS OF LOW ASPECT-RATIO WINGS WITH PARTIAL LEADING-EDGE SEPARATION
Sudhir C. Mehrotra and C. Edward Lan May 1978 132 p
(Grant NsG-1046)
(NASA-CR-145362; CRINC-FRL-266-2) Avail: NTIS HC A07/MF A01 CSCL 01A

The necessary information for using a computer program to predict distributed and total aerodynamic characteristics for low aspect ratio wings with partial leading-edge separation is presented. The flow is assumed to be steady and inviscid. The wing boundary condition is formulated by the Quasi-Vortex-Lattice method. The leading edge separated vortices are represented by discrete free vortex elements which are aligned with the local velocity vector at midpoints to satisfy the force free condition. The wake behind the trailing edge is also force free. The flow tangency boundary condition is satisfied on the wing, including the leading and trailing edges. The program is restricted to delta wings with zero thickness and no camber. It is written in FORTRAN language and runs on CDC 6600 computer. J.M.S.

N80-26289*# Aerospace Systems, Inc., Burlington, Mass.
STEADY, OSCILLATORY, AND UNSTEADY SUBSONIC AND SUPERSONIC AERODYNAMICS, PRODUCTION VERSION (SOUSSA-P 1.1). VOLUME 1: THEORETICAL MANUAL Final Report
Luigi Morino Jan. 1980 134 p
(Contract NAS1-14977)
(NASA-CR-159130; ASI-TR-78-45-Vol-1) Avail: NTIS

HC A07/MF A01 CSCL 01A

Recent developments of the Green's function method and the computer program SOUSSA (Steady, Oscillatory, and Unsteady Subsonic and Supersonic Aerodynamics) are reviewed and summarized. Applying the Green's function method to the fully unsteady (transient) potential equation yields an integro-differential-delay equation. With spatial discretization by the finite-element method, this equation is approximated by a set of differential-delay equations in time. Time solution by Laplace transform yields a matrix relating the velocity potential to the normal wash. Premultiplying and postmultiplying by the matrices relating generalized forces to the potential and the normal wash to the generalized coordinates one obtains the matrix of the generalized aerodynamic forces. The frequency and mode-shape dependence of this matrix makes the program SOUSSA useful for multiple frequency and repeated mode-shape evaluations. A.R.H.

N80-26270*# Boeing Commercial Airplane Co., Seattle, Wash.
AN ADVANCED PANEL METHOD FOR ANALYSIS OF ARBITRARY CONFIGURATIONS IN UNSTEADY SUBSONIC FLOW Contractor Report, Mar. 1978 - Feb. 1980
Arthur R. Dusto and Michael A. Epton Feb. 1980 198 p refs (Contract NAS2-7729)
(NASA-CR-152323; D6-48846) Avail: NTIS HC A09/MF A01 CSCL 01A

An advanced method is presented for solving the linear integral equations for subsonic unsteady flow in three dimensions. The method is applicable to flows about arbitrary, nonplanar boundary surfaces undergoing small amplitude harmonic oscillations about their steady mean locations. The problem is formulated with a wake model wherein unsteady vorticity can be convected by the steady mean component of flow. The geometric location of the unsteady source and doublet distributions can be located on the actual surfaces of thick bodies in their steady mean locations. The method is an outgrowth of a recently developed steady flow panel method and employs the linear source and quadratic doublet splines of that method. Author

N80-26271# Naval Ship Research and Development Center, Annapolis, Md.
NUMERICAL OPTIMIZATION OF CIRCULATION CONTROL AIRFOILS Interim Report, Sep. 1978 - Dec. 1979
Tsze Tai, C., George H. Kidwell, Jr., and Garret N. Vanderplaats Apr. 1980 48 p refs
(DTNSRDC-80/060; Aero-1265) Avail: NTIS HC A03/MF A01

A numerical procedure developed for optimizing the circulation control airfoils is presented. The procedure finds the optimum basic airfoil shapes subjected to specified flow conditions and geometric constraints. It consists of a numerical optimization code for linear constrained problems coupled with a viscous potential flow interaction analysis for necessary viscous inviscid flow field calculations. The desired airfoil shape is defined by a combination of baseline shapes representative of airfoils suitable for circulation control purpose. The coefficients of these basis vectors are then used as the design variables in the optimization process. Three baseline shapes (a cambered ellipse, a cambered ellipse with a drooped trailing edge, and cambered ellipse with a logarithmically spiralled trailing edge) are employed for special contouring of the trailing edge geometry. With some minor modification of the analysis method, the combined program allows optimization for maximum lift without substantial difficulty; but for minimizing the drag, further improvement of the analysis method is required. Author

N80-26272# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SCHLIEREN DIAGNOSTICS OF A HYPERSONIC GAS TARGET NEUTRON GENERATOR
A. A. Haasz and J. H. Lever Feb. 1980 71 p refs Sponsored by National Science and English Research Council of Canada
(UTIAS-242; ISSN-0082-5255) Avail: NTIS HC A04/MF A01

The gasdynamic behavior of a planar model of the Los Alamos geometry hypersonic Gas Target Neutron Generator (GTNG) was investigated using Schlieren flow visualization photographs, static and total pressure and spill flow measurements. The model consisted of two symmetrical expansion nozzles with 220 microns throats producing a combined flow of about Mach 4 in the GTNG channel. Stagnation pressures of 100-800 kPa were used. Two basic flow configurations, spill line closed and spill line open, were studied in order to gain insight into the complex boundary layer development near the nozzle exit planes. Both flow configurations are discussed qualitatively, making use of the pressure measurements and theoretical analysis. Author

N80-26273# Weapons Systems Research Lab., Salisbury (Australia).
IMPROVEMENTS TO THE NSWC AERODYNAMICS PREDICTION PROGRAM OF PARTICULAR SIGNIFICANCE FOR BOMBS
Mar. 1980 19 p refs
(WSRL-0146-TR; AR-001-970) Avail: NTIS HC A02/MF A01

Deficiencies in the Naval Surface Weapons Center missile aerodynamics prediction program were found. Effective corrections were devised. The boattail normal force at subsonic and transonic speeds was given. Normal force results were large in magnitude when the base diameter was small. A correction for boattail center of pressure was included. Due to fuses and lugs on bombs, allowances were devised for truncated nose viscous separation pressure drag at subsonic and transonic speeds, and for excrescence drag at all speeds. An allowance was made for viscous separation drag at the nose shoulder, at transonic speeds. A correction was included to account for the wave drag due to large amounts of nose blunting, including the region near the drag rise Mach number. B.D.

N80-26274*# Cincinnati Univ., Ohio.
A CALCULATION PROCEDURE FOR VISCOUS FLOW IN TURBOMACHINES, VOLUME 3
I. Khalil, Y. Sheoran, and W. Tabakoff Jun. 1980 46 p (Contract NAS3-21609)
(NASA-CR-159864) Avail: NTIS HC A03/MF A01 CSCL 01A

A method for analyzing the nonadiabatic viscous flow through turbomachine blade passages was developed. The field analysis is based upon the numerical integration of the full incompressible Navier-Stokes equations, together with the energy equation on the blade-to-blade surface. A FORTRAN IV computer program was written based on this method. The numerical code used to solve the governing equations employs a nonorthogonal boundary fitted coordinate system. The flow may be axial, radial or mixed and there may be a change in stream channel thickness in the through-flow direction. The inputs required for two FORTRAN IV programs are presented. The first program considers laminar flows and the second can handle turbulent flows. Numerical examples are included to illustrate the use of the program, and to show the results that are obtained. A.R.H.

N80-26276*# National Aeronautics and Space Administration, Washington, D. C.
WORKS ON THEORY OF FLAPPING WING
V. V. Golubev Jun. 1980 140 p refs Transl. into ENGLISH from the book "Trudy po Teorii Mashushchego Kryla" Moscow, State Publishing House of Tech.-Theoret. Lit., 1957 p 399-569 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75750) Avail: NTIS HC A07/MF A01 CSCL 01B

It is shown mathematically that taking account of the boundary layer is the only way to develop a theory of flapping wings without violating the basic observations and mathematics of hydromechanics. A theory of thrust generation by flapping wings can be developed if the conventional downstream velocity discontinuity surface is replaced with the observed Karman type vortex streets behind a flapping wing. Experiments show that the direction of such vortices is the reverse of that of conventional Karman streets. The streets form by breakdown of the boundary layer. Detailed analysis of the movements of certain birds and insects during flight 'in place' is fully consistent with this theory of the lift, thrust and drag of flapping wings. Further directions for research into flight with flapping wings are indicated. Author

N80-26276# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Computational Aerodynamics Group.
RESEARCH IN COMPUTATIONAL AERODYNAMICS Final Report, Jul. 1975 - Sep. 1979
W. L. Hankey Feb. 1980 38 p refs
(AF Proj. 2307)
(AD-A083242; AFFDL-TR-79-3127) Avail: NTIS HC A03/MF A01 CSCL 20/4

Experience obtained by the Computational Aerodynamics Group, WPAFB, in numerically solving viscous flow problems with the Navier-Stokes equations shall be addressed. Topics discussed include grid generation for arbitrary geometries, numerical instabilities, turbulence models, accuracy, efficiency, and smearing of discontinuities. Applications are reported for the method to solve shock wave-boundary layer interactions, 3D interactions, inlets and nozzle flow fields and unsteady viscous flows. GRA

N80-26277# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Analysis and Optimization Branch.
UNSTEADY PRESSURE MEASUREMENTS ON OSCILLATING MODELS IN EUROPEAN WIND TUNNELS
James J. Olsen Mar. 1980 83 p refs
(AF Proj. 2307)
(AD-A083248; AFWAL-TM-80-1-FIBR) Avail: NTIS HC A05/MF A01 CSCL 20/4

The purpose of this report is to summarize the broad aspects of the aerodynamic tests that have been performed over the last twenty years on oscillating bodies and wings in European wind tunnels. While an extensive list of references is available in the open literature, there does not seem to be a general awareness in the United States government or aerospace industry of the intensity and diversity of European efforts. This report gives the background of the development of the major European testing facilities and illustrates the payoffs that have been accrued in the Netherlands, Germany, France and England. GRA

N80-26278# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SUPERSONIC WIND TUNNEL MEASUREMENTS OF STATIC AND MAGNUS AERODYNAMIC COEFFICIENTS FOR PROJECTILE SHAPES WITH TANGET AND SECANT OGIVE NOSES Final Report
Charles J. Nietubicz and Klaus O. Palka Feb. 1980 69 p refs
(DA Proj. 1L6-62618-AH-80)
(AD-A083297; AD-E430401; ARBRL-MR-02991) Avail: NTIS HC A04/MF A01 CSCL 20/4

Wind tunnel tests have been conducted for a series of projectile configurations. The shapes tested include a three caliber secant ogive nose and three caliber tangent ogive nose configuration. The overall model length was fixed at 6 calibers for all configurations tested. Static and Magnus aerodynamic coefficient data were obtained at Mach numbers 2.0, 3.0 and 4.0 for angles of attack up to 10.0 deg. The data are presented in graphical form along with tabulations of the summary data. The tangent ogive nose produced a slight increase in the Magnus moment coefficient when compared to similar secant ogive configurations. The boattail configuration, when compared to the cylinder shapes, was found to increase the Magnus moment; however, this effect was shown to decrease with increasing Mach number. GRA

N80-26279# ARO, Inc., Arnold Air Force Station, Tenn.
INFLUENCE OF WIND TUNNEL NOISE ON THE LOCATION OF BOUNDARY-LAYER TRANSITION ON A SLENDER CONE AT MACH NUMBERS FROM 0.2 TO 5.5. VOLUME 1: EXPERIMENTAL METHODS AND SUMMARY OF RESULTS Final Report, 26 Jan. 1970 - 28 Apr. 1977
N. Sam Dougherty, Jr. Mar. 1980 52 p refs
(AD-A083165; AEDC-TR-78-44-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

A study was conducted to investigate the effects of wind tunnel noise on the location of boundary layer transition. The study was carried out by conducting experiments on a particular slender, highly polished cone having an included angle of 10 deg. Wind tunnel noise levels were measured in the test section by flush mounted microphones imbedded in the cone surface. The measurement of boundary layer transition location was made using either a traversing pitot pressure probe in contact with the cone surface or the flush mounted microphones. The experiments were carried out in 23 different subsonic, transonic, and supersonic wind tunnels over a range of Mach numbers from 0.2 to 5.5 and a unit Reynolds number range from 1.0 to 7.0 million per foot, the bulk of the data being obtained for a range from 2.0 to 4.0 million per foot. The results clearly show a strong influence of wind tunnel noise on boundary layer transition location correlatable with overall root mean square noise levels. Because the noise level generally varied with Mach number and unit Reynolds number, the unit Reynolds number was found to have little effect on transition Reynolds number. GRA

N80-26280# ARO, Inc., Arnold Air Force Station, Tenn.
INFLUENCE OF WIND TUNNEL NOISE ON THE LOCATION OF BOUNDARY-LAYER TRANSITION ON A SLENDER CONE AT MACH NUMBERS FROM 0.2 TO 5.5. VOLUME 2: TABULATED AND PLOTTED DATA Final Report, 26 Jan. 1970 - 28 Apr. 1977
N. Sam Dougherty, Jr. Mar. 1980 249 p refs
(AD-A083166; AEDC-TR-78-44-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 20/4

A study was conducted to investigate the effects of wind tunnel test section noise on the location of boundary-layer transition. The study was carried out by conducting experiments on a slender, highly polished cone with an included angle of 10 deg. Wind tunnel test section noise was measured by microphones flush-mounted on the cone surface. In most of the experiments, boundary-layer transition was measured with a surface-mounted, traversing pitot pressure probe. The experiments were conducted in 23 different subsonic, transonic, and supersonic wind tunnels over a Mach number range from 0.2 to 5.5 and a unit Reynolds number range from 1.0 to 7.0 million per foot, the bulk of the data being obtained between 2.0 and 4.0 million per foot. The results show an influence of wind tunnel noise on boundary-layer transition for most of the wind tunnels. GRA

N80-26281# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AERODYNAMICS IN THE NEIGHBORHOOD OF A ROTATING SPOILER B.S. Thesis
W. U. Leong and I. Tsangoulis Jun. 1979 87 p refs
(BU-232) Avail: NTIS HC A05/MF A01

The aerodynamic characteristics of a three dimensional spoiler with controllable rotary speed are investigated using three different flow visualization techniques and pressure measurements. Both vented and unvented spoilers with ratios of free stream speed to spoiler tip speeds of 126 or less were studied. Results indicate that the spoiler aerodynamic hinge force is directly related to the opening rate, but the maximum static force is related only to free stream speed. The size of a separation bubble behind the unvented spoiler also depended on opening rate, but was unrelated to free stream speed in the range tested.Author (ESA)

N80-26282# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Environmental and Applied Fluid Dynamics Dept.
ANALYTICAL MODELING OF MEAN PRESSURE DISTRIBUTION AROUND A TWO-DIMENSIONAL CIRCULAR CYLINDER AT HIGH REYNOLDS NUMBERS
J. P. Borleteau, D. Livari, and A. Turi Sep. 1979 28 p refs
(VKI-TN-134) Avail: NTIS HC A03/MF A01

Two analytical models which describe the mean flow pressure distribution around a two dimensional circular cylinder at high Reynolds numbers are presented. The first model reproduces the cylinder and the wake region using a conformal mapping technique, whereas the second model describes the cylinder and the wake boundaries by linear segments of distributed vorticity (panel method). Neither model considers the flow field within the wake region. Only the external potential flow is studied. The input data for the two models, namely the base pressure and the position of the separation point, are provided by experimental results which are also compared with the computed pressure distribution. Both models lead to a computed pressure distribution which is generally in good agreement with the experimental data when considering a smooth cylinder. However, only the second model provides satisfactory matching in the case of cylinders with surface roughness where the boundary layer thickness has a strong influence on the location and the

level of the peak suction as well as on the pressure rise which follows up to separation. The second model allows the boundary layer effects to be taken into account by adding to the geometrical shape of the cylinder the displacement thickness of the layer.
Author (ESA)

N80-26283# Royal Aircraft Establishment, Farnborough (England).
THE FORM OF THE SOLUTIONS OF THE LINEAR INTEGRO-DIFFERENTIAL EQUATIONS OF SUBSONIC AEROELASTICITY
D. L. Woodcock London HMSO Sep. 1979 48 p refs
(RAE-TM-Struct-956; BR70935) Avail: NTIS HC A03/MF A01

The solution of the subsonic flutter problem, when the commonly used linear differential equation model is replaced by the more correct linear integro-differential equation model, is studied, and the nature of the system's free motion established. The different forms appropriate to two dimensional and three dimensional flow, and to the cases when the system has a zero characteristic value, are developed in detail. It is shown that, for large time t, the behavior can variously be like 1, 1/log t, 1/tsq, 1/tcu.
Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also 16 Space Transportation and 85 Urban Technology and Transportation.

N80-26284*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FUSELAGE VENTILATION DUE TO WIND FLOW ABOUT A POSTCRASH AIRCRAFT
Jay W. Stuart 15 Jun. 1980 26 p refs
(Contract NAS7-100)
(NASA-CR-163273; JPL-Pub-80-36) Avail: NTIS HC A03/MF A01 CSCL 01C

Postcrash aircraft fuselage fire development, dependent on the internal and external fluid dynamics is discussed. The natural ventilation rate, a major factor in the internal flow patterns and fire development is reviewed. The flow about the fuselage as affected by the wind and external fire is studied. An analysis was performend which estimated the rates of ventilation produced by the wind for a limited idealized environmental configuration. The simulation utilizes the empirical pressure coefficient distribution of an infinite circular cylinder near a wall with its boundary later flow to represent the atmospheric boundary layer. The resulting maximum ventilation rate for two door size openings, with varying circumferential location in a common 10 mph wind was an order of magnitude greater than the forced ventilation specified in full scale fire testing. The parameter discussed are: (1) fuselage size and shape, (2) fuselage orientation and proximity to the ground, (3) fuselage-openings size and location, (4) wind speed and direction, and (5) induced flow of the external fire plume is recommended. The fire testing should be conducted to a maximum ventilation rate at least an order of magnitude greater than the inflight air conditioning rates.
B.D.

N80-26285*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
PRELIMINARY RESULTS OF SIMULATED VORTEX ENCOUNTERS BY A TWIN-ENGINE, COMMERCIAL AIRCRAFT DURING FINAL LANDING APPROACH
Earl C. Hastings, Jr., G. Thomas Holbrook, and Gerald L. Keyser, Jr. May 1980 56 p refs
(NASA-TM-81782) Avail: NTIS HC A04/MF A01 CSCL 01C

Piloted simulations of encounters with vortices of various ages and degrees of attenuation were performed with the Visual Motion Simulator. In the simulations, a twin engine, commercial transport on final approach, encountered the modeled vortices of a four engine, wide body, commercial transport. The data show the effect of vortex age and attenuation on the severity of the initial upset, as well as the effect of the vortex encounters on the landing capability.
Author

N80-26286# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AVIATION ISSUE NUMBER 8, 1979 ACCIDENTS
25 Jun. 1980 170 p
(NTSB-BA-80-5) Avail: NTIS HC A08/MF A01

Three hundred general aviation aircraft accident reports, occurring in the U.S. civil aviation operations during calendar year 1979 are discussed. The facts, conditions, circumstances, and probable cause (s) for each accident are studied. Additional statistical information is tabulated by injury index injuries and causal factors.
B.D.

N80-26287# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: COMAIR, INC., PIPER PA-31-310, NAVAJO, N8642L, GREATER CINCINNATI AIRPORT, COVINGTON, KENTUCKY, 8 OCTOBER 1979
28 May 1980 36 p
(NTSB-AAR-80-8) Avail: NTIS HC A03/MF A01

On October 8, 1979, at 1008:26, COMAIR, Inc., Flight 444, a Piper PA31-310, with a pilot and seven passengers on board, crashed on takeoff from runway 18 at the Greater Cincinnati Airport, Covington, Kentucky. The pilot and the seven passengers on board were killed, and the aircraft was distroyed. After 1,500 to 2,000 ft of takeoff roll, the aircraft lifted off abruptly and climbed slowly to about 150 ft above the runway. Following liftoff, the pilot reported a loss of power from an engine, and the tower controller cleared the pilot to return and land. Seconds later, the aircraft rolled to the right to an inverted position and dove, nose first, to the ground. The National Transportation Safety Board determines that the probable cause of the accident was the loss of control following a partial loss of power immediately after liftoff. The accident could have been avoided if either the pilot had rejected the takeoff or had raised the landing gear and flaps. His failure to take decisive action may have been due to preoccupation with correcting the malfunction, and a lack of familiarity with the aircraft and with its emergency procedures. Contributing to the accident was the pilot's inexperience in multiengine aircraft, a hurried departure, inadequate training, inexperienced company management, and ineffective FAA certification and surveillance of the operator.
Author

N80-26288# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Technical and Resources Management Div.
AERONAUTICAL SYSTEMS TECHNOLOGY NEEDS: ESCAPE, RESCUE AND SURVIVAL Annual Report
D. C. Kittinger Feb. 1980 34 p Supersedes ASD-TR-79-5038
(AD-A083552; ASD-TR-80-5010; ASD-TR-79-5038) Avail: NTIS HC A03/MF A01 CSCL 06/7

This report is a part of a compilation of formalized Technology Needs (TN) covering Equipment Subsystems as identified in the Aeronautical Systems Division. They are based on development/operational experience, systems studies and new concepts - all related to future system applications. Their presentation is to serve a threefold purpose; i.e., (1) guidance for technology program, (2) proven developmental potential, and (3) engineering data/requirements essential for technology use in systems. The identified needs delineate progress desired in performance, control, design flexibility, safety and cost.
GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also 17 Spacecraft Communications, Command, and Tracking and 32 Communications.

N80-26289# Megatek Corp., San Diego, Calif.
OMEGA HAWAII ANTENNA SYSTEM: MODIFICATION

AND VALIDATION TESTS. VOLUME 1: REPORT PROPER Final Report
J. C. Hanselman 19 Oct. 1979 143 p
(Contract N00123-78-C-0043)
(AD-A082114; NOSC-TR-493-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 17/7

Electronic measurements were performed on the Hawaii Omega Antenna System during the months of May and June 1978 and March and May 1979. The work was performed under NOSC Project MP015 B10 with Megatek as contractor. The electrical height of the antenna is 169 metres for all frequencies. The station can easily radiate more than 10 kW on all frequencies. There is no measurable deviation from omnidirectional radiation due to the proximity of the Haiku Valley walls to the south, west, and north of the antenna. The apparent capacitance of the antenna was measured. Also, the inductance of the spare variometer and its variation was measured. From these preliminary measurements, the optimum location of the 11.050 kHz helix tap was determined and connected. The value of the antenna system's resistance was measured on three days of different weather conditions and found to vary. This variation is related to the degree of salt deposit on the antenna insulators. A recommended set of gear ratios for the variometer gear boxes is determined. GRA

N80-26290# Megatek Corp., San Diego, Calif.
OMEGA HAWAII ANTENNA SYSTEM: MODIFICATION AND VALIDATION TESTS. VOLUME 2: DATA SHEETS Final Report
J. C. Hanselman 19 Oct. 1979 112 p
(Contract N00123-78-C-0043)
(AD-A082115; NOSC-TR-493-VOI-2) Avail: NTIS HC A06/MF A01 CSCL 17/7

During the performance of modification and validation tests at OMEGA Hawaii, data and all pertinent information collected were recorded on appropriate data sheets. Data sheets designed to facilitate analysis and computation of desired operating parameters are presented. E.D.K.

N80-26291# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE 29TH GUIDANCE AND CONTROL PANEL SYMPOSIUM ON AIR TRAFFIC MANAGEMENT. CIVIL/MILITARY SYSTEMS AND TECHNOLOGIES
C. deBruyn (Liege Univ., Belgium) Mar. 1980 20 p Symp. held at Copenhagen, 9-12 Oct. 1979
(AGARD-AR-149; ISBN-92-835-1356-8) Avail: NTIS HC A02/MF A01

Air traffic control is considered as a joint civil/military system with emphasis on the caom compatibility, the coordination, and the complementary aspects of the civil and military components. The adequacy of those ATC concepts in current use is discussed and recent advances in technology are reviewed. J.M.S.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-26292# National Inst. for Aeronautics and Systems Technology, Pretoria (South Africa).
THE ANALYTICAL PREDICTION OF THE SEPARATION BEHAVIOUR OF EXTERNAL STORES AFTER RELEASE FROM THE CARRIER AIRCRAFT. PART 2: APPLICATIONS
G. J. vandenBroek Aug. 1979 225 p refs
(CSIR-NIAST-79/103-Pt-2; ISBN-0-7988-1650-3) Avail: NTIS HC A10/MF A01

An analytical store separation prediction method was developed. The method is based on inviscid linear potential theory for subsonic and supersonic flow. The aircraft and external store are divided into a large number of panels, each of which contains an aerodynamic singularity distribution. Source and vortex distributions are used. The strengths of the singularities are determined and the store loads obtained. The store loads are combined with the six-degree-of-freedom equations of motion to provide the separation characteristics of the store. Various aspects of the computational method are investigated in considerable detail. Approximative schemes are studied to speed up the calculations, resulting in an economical separation prediction method. Extensive comparisons with experimental data regarding the various aspects of the computational method, are included. In general, satisfactory agreement is observed. Areas for improvement are defined. F.O.S.

N80-26293*# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.
DESIGN STUDIES OF LAMINAR FLOW CONTROL (LFC) WING CONCEPTS USING SUPERPLASTICS FORMING AND DIFFUSION BONDING (SPF/DB) Final Report, Aug. 1978 - Sep. 1979
Vernon E. Wilson May 1980 114 p refs
(Contract NAS1-15488)
(NASA-CR-159220) Avail: NTIS HC A06/MF A01 CSCL 01C

Alternate concepts and design approaches were developed for suction panels and techniques were defined for integrating these panel designs into a complete LFC 200R wing. The design concepts and approaches were analyzed to assure that they would meet the strength, stability, and internal volume requirements. Cost and weight comparisons of the concepts were also made. Problems of integrating the concepts into a complete aircraft system were addressed. Methods for making splices both chordwise and spanwise, fuel tight joints, and internal duct installations were developed. Manufacturing problems such as slot aligment, tapered slot spacing, production methods, and repair techniques were addressed. An assessment of the program was used to developed recommendations for additional research in the development of SPF/DB for LFC structure. E.D.K.

N80-26294# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
EVOLUTION OF MATERIALS AND ASSOCIATED TECHNOLOGIES IN AEROSPACE MATERIAL STRUCTURES [EVOLUTION DES MATERIAUX ET DES TECHNOLOGIES ASSOCIEES DANS LES STRUCTURES DE MATERIALS AEROSPATIAUX]
G. Sertour and G. Hilaire 30 May 1979 57 p In FRENCH Presented at 14th Congr. Intern. Aeron., Paris, 8-8 Jun. 1979
(SNIAS-792-551-106) Avail: NTIS HC A04/MF A01

A brief history of developments is given. Specific topics examined include: propagation of fatigue cracks, stress corrosion, aluminum alloy forming processes, and composite materials. Selected applications are illustrated: tanks for the 1st stage of Ariane, structures of the Mirage 2000, Concorde and Airbus a 300B aircraft and Intelsat 5, Marecs antenna, a rigid solar generator, Ariane's double launching system, composite carbon-carbon materials with multidirectional armatures, and a Kevlar coil for a propulsion device. Author (ESA)

N80-26295# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
QUALITY OF NONMETALLIC MATERIALS [QUALITE DES MATERIAUX NON METALLIQUES]
G. Hilaire 28 Aug. 1979 38 p In FRENCH Presented at Forum Intern. Mater. Composites, Collage et Adhesion, Lyon, 11-14 Sep. 1979
(SNIAS-792-551-108) Avail: NTIS HC A03/MF A01

Some philosophical and practical considerations are put forward concerning the difficulties of ensuring adequate quality control. Relevant parameters are defined. Composition, guarantees as far as raw materials are concerned, and manufacturing procedures are discussed. Fabrication parameters (ambient conditions, polymerization conditions, manufacturing time) are examined together with the qualities of individual manufactured parts, failure probabilities and the nondestructive testing procedures employed. The results of some specific tests and experiments are given. Author (ESA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also 19 Spacecraft Instrumentation and 35 Instrumentation and Photography.

N80-26296*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HEAD-UP DISPLAY IN THE NON-PRECISION APPROACH

J. M. Naish May 1980 20 p refs

(NASA-TM-81167; A-8061) Avail: NTIS HC A02/MF A01 CSCL 01D

The problem of head-up guidance for an aircraft making an instrument approach without glide slope information is discussed. Requirements for path control are considered for each section of the approach profile and a head-up display is developed to meet these needs. The display is an unreferenced flight director which is modified by adding a ground referenced symbol as an alternative guidance component. The director is used for holding altitude in the first segment and for descent at a controlled rate in the second segment. It is used in the third segment to maintain the minimum decision altitude while assessing the approach situation. This is done by means of occasional brief changes to the referenced symbol. In the final segment a visual approach is made with the referenced symbol used continuously for path control. The display is investigated experimentally in simulated approaches made by three pilots. The results show a fair agreement between objective and subjective estimates of the quality of landing decisions. E.D.K.

N80-26297*# Old Dominion Univ. Research Foundation, Norfolk, Va.

EXPERIMENTAL AND ANALYTICAL STUDIES OF A TRUE AIRSPEED SENSOR Final Report, period ending 29 Feb. 1980

G. L. Goglia and J. Y. Shen Jun. 1980 173 p refs

(Grant NsG-1177)

(NASA-CR-163261) Avail: NTIS HC A08/MF A01 CSCL 10D

A true airspeed sensor having a flow phenomenon which is the vortex precession or the vortex whistle, no moving parts, and is independent of temperature, density, altitude, or humidity changes is proposed. The designed sensor consists basically of a vortex tube, a swirler, and a pickup system. When air passes through the swirler a precessional flow is generated at the region before and after the sudden enlargement area. An audible vortex whistle is generated, the signal picked up by the microphone, and the frequency response shown in a frequency counter. Measurements for both the closed conduit test and wind tunnel test are recorded. A computer is used to obtain the numerical solution. For a specific flow rate or airspeed, the larger the exit swirler angle, the greater the frequency response. For a smaller cross sectional area at a precessional flow region, the frequency response is higher. As the airspeed is increased the Strouhal number, dependent only on the exit angle of the swirler, remains constant. E.D.K.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

N80-26298* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

REDUCTION OF NITRIC OXIDE EMISSIONS FROM A COMBUSTOR Patent

Roger A. Craig and Huw O. Pritchard, inventors (to NASA) Issued 27 May 1980 6 p Filed 8 Sep. 1977 Supersedes N77-31260 (15 - 22, p 2912) Continuation of abandoned US Patent Appl. SN-684045, filed 7 May 1976

(NASA-Case-ARC-10814-2; US-Patent-4,204,402; US-Patent-Appl-SN-831632; US-Patent-Class-60-39.06; US-Patent-Class-60-733; US-Patent-Class-60-746; US-Patent-Appl-SN-684045) Avail: US Patent and Trademark Office CSCL 21E

A turbojet combustor and method for controlling nitric oxide emissions by employing successive combustion zones is described. After combustion of an initial portion of the fuel in a primary combustion zone, the combustion products of the primary zone are combined with the remaining portion of fuel and additional plenum air and burned in a secondary combustion zone under conditions that result in low nitric oxide emissions. Low nitric oxide emissions are achieved by a novel turbojet combustor arrangement which provides flame stability by allowing stable combustion to be accompanied by low nitric oxide emissions resulting from controlled fuel-lean combustion (ignited by the emission products from the primary zone) in a secondary combustion zone at a lower combustion temperature resulting in low emission of nitric oxide.

Official Gazette of the U.S. Patent and Trademark Office

N80-26299*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DURABILITY TESTS OF SOLENOID VALVES FOR DIGITAL ACTUATORS

A. N. Baez Jun. 1980 11 p refs

(NASA-TM-81522; E-466) HC A02/MF A01 CSCL 21E

The durability of various materials used to make solenoid valve poppets and seats was investigated. Six different poppet materials and two seat materials were considered. Each material was tested for over 100 million cycles. Serious damage was found in four kinds of poppet materials tested. Less damage was evident in an aluminum poppet and in graphite composite poppet. The graphite composite poppet in combination with a Vespel seat was considered the most promising combination for use in digital electronic controls for gas turbine engines. E.D.K.

N80-26300*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.

EXPERIMENTAL AERODYNAMIC AND ACOUSTIC MODEL TESTING OF THE VARIABLE CYCLE ENGINE (VCE) TESTBED COANNULAR EXHAUST NOZZLE SYSTEM

D. P. Nelson and P. M. Morris 15 Jun. 1980 83 p

(Contract NAS3-20061)

(NASA-CR-159710; PWA-5550-31) Avail: NTIS HC A05/MF A01 CSCL 21E

Aerodynamic performance and jet noise characteristics of a one sixth scale model of the variable cycle engine testbed exhaust system were obtained in a series of static tests over a range of simulated engine operating conditions. Model acoustic data were acquired. Data were compared to predictions of coannular model nozzle performance. The model, tested with and without a hardwall ejector, had a total flow area equivalent to a 0.127 meter (5 inch) diameter conical nozzle with a 0.65 fan to primary nozzle area ratio and a 0.82 fan nozzle radius ratio. Fan stream temperatures and velocities were varied from 422 K to 1089 K (760 R to 1960 R) and 434 to 755 meters per second (1423 to 2477 feet per second). Primary stream properties were varied from 589 to 1089 K (1060 R to 1960 R) and 353 to 600 meters per second (1158 to 1968 feet per second). Exhaust plume velocity surveys were conducted at one operating condition with and without the ejector installed. Thirty aerodynamic performance data points were obtained with an unheated air supply. Fan nozzle pressure ratio was varied from 1.8 to 3.2 at a constant primary pressure ratio of 1.6; primary pressure ratio was varied from 1.4 to 2.4 while holding fan pressure ratio constant at 2.4. Operation with the ejector increased nozzle thrust coefficient 0.2 to 0.4 percent. B.D.

N80-26301*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.

EXPERIMENTAL AERODYNAMIC AND ACOUSTIC MODEL TESTING OF THE VARIABLE CYCLE ENGINE (VCE) TESTBED COANNULAR EXHAUST NOZZLE SYSTEM: COMPREHENSIVE DATA REPORT

D. P. Nelson and P. M. Morris Jun. 1980 225 p

(Contract NAS3-20061)
(NASA-CR-159711; PWA-5550-40) Avail: NTIS HC A10/MF A01 CSCL 21E

The component detail design drawings of the one sixth scale model of the variable cycle engine testbed demonstrator exhaust system tested are presented. Also provided are the basic acoustic and aerodynamic data acquired during the experimental model tests. The model drawings, an index to the acoustic data, an index to the aerodynamic data, tabulated and graphical acoustic data, and the tabulated aerodynamic data and graphs are discussed. B.D.

N80-26302*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

CF6 JET ENGINE PERFORMANCE IMPROVEMENT PROGRAM: HIGH PRESSURE TURBINE AERODYNAMIC PERFORMANCE IMPROVEMENT

W. A. Fasching Jul. 1980 156 p refs
(Contract NAS3-20629)
(NASA-CR-159832) Avail: NTIS HC A08/MF A01 CSCL 21E

The improved single shank high pressure turbine design was evaluated in component tests consisting of performance, heat transfer and mechanical tests, and in core engine tests. The instrumented core engine test verified the thermal, mechanical, and aeromechanical characteristics of the improved turbine design. An endurance test subjected the improved single shank turbine to 1000 simulated flight cycles, the equivalent of approximately 3000 hours of typical airline service. Initial back-to-back engine tests demonstrated an improvement in cruise sfc of 1.3% and a reduction in exhaust gas temperature of 10 C. An additional improvement of 0.3% in cruise sfc and 6 C in EGT is projected for long service engines. Author

N80-26303# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

THEORETICAL PERFORMANCE FOR NON-STATIC EJECTOR THRUST AUGMENTORS Final Report, Feb. - Sep. 1979

James S. Petty Jan. 1980 54 p
(AF Proj. 3066)
(AD-A083246; AFAPL-TR-79-2120) Avail: NTIS HC A04/MF A01 CSCL 21/5

An analytical study was performed to determine the theoretical limits on the performance of nonstatic ejector thrust augmentors. Idealizing assumptions were made, such as inviscid compressible working fluids, isentropic flows in inlets, diffusers, nozzles and ducts, constant pressure mixing, and thermally and calorically perfect fluids. By ignoring details of the primary flow 'pump', the performance of ejector augmentors was found in terms of three parameters (the secondary/primary mass flow ratio, a pressure parameter and a temperature parameter) in a form which was not an explicit function of the flight Mach number. It was also shown that multi-stage ejectors offered no performance improvement over ideal single-stage ejectors. Two primary 'pump' devices, a turbine engine gas generator and an isentropic compressor, were considered. With them, the Mach number dependent behavior of ideal ejectors was determined. As a result of this study, the following conclusions were drawn: (1) the performance of ideal ejector is severely degraded by increasing the primary fluid temperature, (2) the performance of ideal ejectors is degraded faster than that of ideal turbofans as the flight Mach number is increased, (3) neither the turbine engine nor the isentropic compressor is a suitable 'pump' for ideal ejectors, except at very low Mach numbers, and (4) ejector augmentors should be most useful for low flight speed applications; e.g., V/STOL. GRA

N80-26304# Boeing Aerospace Co., Seattle, Wash. Boeing Military Airplane Development.

PIPSI/NAVY RAPID EVALUATION OF PROPULSION SYSTEM EFFECTS FOR THE NAVY GAS TURBINE ENGINE CODE NEPCOMP Final Report, 28 Jun. - 11 Oct. 1979

W. H. Ball 11 Oct. 1979 58 p refs
(Contract N62269-79-C-0278)
(AD-A083172; NADC-TM-79081-60) Avail: NTIS HC A04/MF A01 CSCL 21/5

This report describes the work accomplished during a fourteen-week contract to modify two existing interactive computer programs for calculating installed engine performance, including inlet and nozzle corrections and to demonstrate their use for the NADC. GRA

N80-26305# Naval Air Test Center, Patuxent River, Md. Strike Aircraft Test Directorate.

A COMPREHENSIVE APPROACH IN-FLIGHT THRUST DETERMINATION

Paul W. Chapin 15 Feb. 1980 22 p
(AD-A081511; NATC-TM-3-SA) Avail: NTIS HC A02/MF A01 CSCL 21/5

A systematic, comprehensive approach was used recently to develop an in-flight thrust computational routine for a mixed-flow, dual spool, augmented turbofan engine with a variable area convergent-divergent exhaust nozzle. To provide an insight for the necessity of this approach, a brief historical background of in-flight thrust measurement is presented and classical nozzle theory is discussed briefly. The development of the computational routine is discussed and some general test planning guidelines are presented. GRA

N80-26306# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

ADVANCED CONTROL SYSTEMS FOR AIRCRAFT POWERPLANTS

Feb. 1980 226 p refs Partly in ENGLISH and FRENCH
Presented at the 54th Propulsion and Energetics Panel Specialist's Meeting, Cologne, 1-2 Oct. 1979
(AGARD-CP-274; ISBN-92-835-0258-2) Avail: NTIS HC A11/MF A01

Control systems for aircraft power units are discussed. Areas of consideration are: development experience; control implementation; optimum control strategies; and digital control concepts. For individual titles, see N80-26307 through N80-26325.

N80-26307*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPACE SHUTTLE MAIN ENGINE DIGITAL CONTROLLER

Walter T. Mitchell *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 11 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

The controller provides responsive control of engine thrust and mixture ratio through the digital computer in the controller, updating the instructions to the engine control elements 50 times per second (every 20 milliseconds). Additionally, precise engine performance is achieved through closed loop control, utilizing 16 bit computation, 10 bit input/output resolution, and self calibrating analog-to-digital conversion. Engine reliability is enhanced by a dual redundant control system that allows normal operation after the first failure and a fail-safe shutdown after a second failure. The digital computer is programmable, allowing modification of engine control equations and constants by change of the stored program (software). The controller is packaged in a sealed, pressurized chassis with cooling provided by convection heat transfer through pin fins as part of the main chassis. The electronics are distributed on functional modules having special provisions for thermal and vibrational protection. R.C.T.

N80-26308# Rolls-Royce Ltd., Bristol (England).

EXPERIMENTAL FULL-AUTHORITY DIGITAL ENGINE CONTROL ON CONCORDE

J. McNamara, C. G. Legge, and E. Roberts (Sperry Gyroscope Co., Great Neck, N.Y.) *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 17 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The first ever flight standard full-authority digital engine controller is described. As well as the existing dry engine control and monitoring functions, the controller incorporated reheat control, fault recording and ground-check, and fitted into the same volume as the existing analogue dry engine controller. Particular emphasis is given to computer monitoring techniques and the production of high-integrity software. R.C.T.

N80-26309# VDO-Luftfahrtgeraete Werk Adolf Schindling G.m.b.H., Frankfurt (West Germany).

THE SECONDARY POWER SYSTEM CONTROL UNIT, AND ELECTRONIC SUBSYSTEM IN THE PANAVIA TORNADO
W. Bender *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 8 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The Secondary Power System Control Unit is discussed with emphasis on system configuration. The automatic starting cycle of the APU operation of the accessory drive gearboxes under well defined speed and accaleration conditions as well as the starting phase of the aircraft engines are described. R.C.T.

N80-26310# Bendix Corp., South Bend, Ind. Electronic Controls Div.
CONCURRENT DEVELOPMENT AND TEST OF A DIGITAL ELECTRONIC CONTROLLER WITH AN ADVANCED VARIABLE CYCLE ENGINE
Richard W. Cording and Frank J. OKeefe *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 10 p Prepared in cooperation with Detroit Diesel Allison, Indianapolis, Ind. (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The need for high performance systems with wide operating envelopes is discussed with respect to the design of advanced technology variable cycle engines. A program is described in which full authority digital electronic controller is used as a tool in the development of an advanced technology variable cycle engine. The problems and advantages associated with an advanced variable cycle engine are highlighted in a discussion of the control system development. R.C.T.

N80-26311# Societe Microturbo, Toulouse (France).
A NEW FUEL SUPPLY CONTROL SYSTEM FOR SMALL TURBOMACHINES [NOUVEAU SYSTEME DE COMMANDE DE DEBIT DE CARBURANT POUR PETITES TURBOMACHINES]
F. Arnaud, J. Gonzales, and B. Secher *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 13 p In FRENCH (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Small turbomachines used as starting systems or as autonomous power groups require specific devices for controlling fuel flow. The constraints proper to these turbomachines and the different solutions possible are reviewed. The underlying principle and operations are described for an original system which is composed of an electropump whose speed can be varied by an electronic device and a simplified pressure differential regulator. The main problems encountered in two particular applications are discussed. Transl. by A.R.H.

N80-26312# Plessey Aerospace Ltd., Titchfield (England).
TRANSDUCERS FOR ENGINE CONTROL SYSTEMS
G. E. Davies *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 12 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Some active fluidic transducers which measure the fundamental nondimensional quantities required for engine control systems are described. The use of these transducers offers a true nondimensional measurement of engine performance and allows the system designer a freer choice of control parameters. R.C.T.

N80-26313# Pierburg Luftfahrtgeraete Union G.m.b.H., Neuss (West Germany).
A COMBINED PARALLEL-DIGITAL AND PULSE-DURATION MODULATED FUEL METERING SYSTEM
H. Holzem *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 6 p refs (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

A fuel metering system is presented which is controlled parallel-digitally by a computer. This system is preferably suited for small and medium size engines. High accuracy requirements coupled with both robust and simple construction are met. The design and functional description is supplemented by the laboratory test results so far achieved. R.C.T.

N80-26314# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Suresnes (France).
THE APPLICATION OF MICROPROCESSORS TO THE REGULATION OF MILITARY AIRCRAFT ENGINES: THE DESIGN OF ELECTRONIC REGULATORS [APPLICATION DES MICROPROCESSEURS A LA REGULATION DES MOTEURS D'AVIONS MILITAIRES. CONCEPTION DES REGULATEURS ELECTRONIQUES]
J. M. Collin and B. Gaj *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 16 p refs In FRENCH (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The availability of highly integrated circuits offers the designer new possibilities for rationally defining automatons numerically integrated in the engine regulating system. The architecture of these automatons is defined by simultaneously taking into consideration functional specifications, operational specifications which have an important bearing on the reliability and security of missions, and the technological constraints imposed by an aggressive environment. The possibilities offered by microprocessors are illustrated with a summary description of three types: a minicomputer type regulator, a multimicroprocessor system, and a regulator with a data processor. Transl. by A.R.H.

N80-26315# Hawker Siddeley Dynamics Ltd., Hatfield (England).
THE DESIGN CONCEPT AND EXPERIMENTAL RESULTS USING THE INTEL 8080/8085 MICROPROCESSOR
Nicholas A. Justice *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 9 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Prototype flight equipment was built using the 8080A and is flying with full authority in a twin engine helicopter. Isochronous load sharing on torque with simultaneous data logging output of transducer inputs and control functions was provided for monitoring purposes. This detailed background provided valuable insight to the true flexibility of a microprocessor controller and also illustrated any shortcomings that the later generation devices will need to overcome. R.C.T.

N80-26316*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
DESIGN, EVALUATION AND TEST OF AN ELECTRONIC, MULTIVARIABLE CONTROL FOR THE F100 TURBOFAN ENGINE
Charles A. Skira (Systems Control, Inc., Palo Alto, Calif.), Ronald L. DeHoff, and W. Earl Hall, Jr. (Systems Control, Inc., Palo Alto, Calif.) *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 21 p refs Sponsored in part by NASA (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

A digital, multivariable control design procedure for the F100 turbofan engine is described. The controller is based on locally linear synthesis techniques using linear, quadratic regulator design methods. The control structure uses an explicit model reference form with proportional and integral feedback near a nominal trajectory. Modeling issues, design procedures for the control law and the estimation of poorly measured variables are presented. R.C.T.

N80-26317# Pisa Univ. (Italy).
ENGINE INTAKE CONTROL DESIGN FOR ADVANCED FIGHTER AIRCRAFT
Dino Dini and R. Lazzeretti *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 11 p refs (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The factors influencing variable geometry intake design for fighter aircraft over their flight velocity profile are reviewed. Separate operating performance ranges, depending on the positions of the changeover valves, ramps and doors, are analyzed for an acceptable design compromise. A criterion for prediction of airframe integration effects on inlet stability with application to advanced fighter aircraft is presented and discussed. To accomodate desired flow changes through the engine as flight speed, altitude, and climatic conditions, change, the control of intake is studied and designed, taking into account mutual interferences between propulsion units and controlled elements.

Airframe/propulsion integration in fighter aircraft is considered in the design of intake control. M.G.

N80-26318# Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Automatique.
DETERMINING THE OPTIMAL CONTROL LAWS FOR SETTING THE RPM'S OF A TURBOJET ENGINE [DETERMINATION DE LOIS OPTIMALES DE MONTEE EN REGIME D'UN TURBOREACTEUR]
C. Barrouil *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 4 p refs In FRENCH (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Two operational modes can be distinguished for a simple body turbojet engine without afterburning: changing the limits and regulating the limits. A rapid change of limits is desirable but a suitable margin of safety must be assured during the transition and the engine must be left in a practically stabilized state after the transition. The engine controls are the fuel flow and the tail pipe section. They are released by actuators which are themselves controlled by a digital or analog computer or electromechanically. The control laws are not sought for the actuators directly, but for the fuel flow and the optimal tail pipe section. The laws determined are those displayed on the actuators. Transl. by A.R.H.

N80-26319# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
MODE CONTROL: A FLEXIBLE CONTROL CONCEPT FOR MILITARY AIRCRAFT ENGINES
Klaus Bauerfeind *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 9 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

An engine control concept (mode control) which will minimize the aircraft performance penalties due to normal engine matching to severe handling requirements is described. In mode control these penalties are reduced by matching the engine closer to the optimum steady state performance of the aircraft. Extreme flight conditions are registered and signalled to an electronic control system. This control system then trims and overrides the normal control laws in order to provide the necessary margins required for safe operation so long as the extreme condition prevails. In order to implement mode control successfully the response rates of the engine variables or trims must be compatible with the requirements, i.e., the respective rates at which a certain problem can develop. Because of the type of computing required a digital control system is more suitable for this task than an analogue one. The example of a military three spool by-pass engine equipped with an afterburner is presented. M.G.

N80-26320# Smiths Industries Ltd., Basingstoke (England). Aviation Div.
REDUNDANCY CONCEPTS IN FULL AUTHORITY ELECTRONIC ENGINE CONTROL, PARTICULARLY DUAL REDUNDANCY
E. S. Eccles, E. D. Simons (Dowty and Systems, Cheltenham, England), and J. F. O. Evans *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 14 p (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The available methods of redundancy in full authority electronic engine controls and the reasons for their selection in particular applications are surveyed with particular reference to the effects of the electro-hydromechanical interface. Various 'dual' redundant arrangement, Adour and Pegasus engine controls, and helicopter controls are specifically addressed. System safety and the variety of failure survival strategies which can be employed are considered. In general, ease of analysis is accompanied by simple failure survival strategies. More complex strategies may result in higher system availabilities and there is therefore a trade-off to conduct between non-recurring design cost and system availability in service. The impact of more flexible system architectures due to microprocessors and military requirements are discussed and the direction of future development is indicated. M.G.

N80-26321# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Bureau d'Etudes Installation Motrice.
CONTROL OF THE ENGINES FOR THE NEW AIRBUS FAMILY [CONDUITE DES MOTEURS DE LA NOUVELLE FAMILLE AIRBUS]
Jean-Claude Tchavdarov *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 14 p refs (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The general problem of engine performance is considered including the objectives to be satisfied and the basic principles to be retained. The operation of the A-300 aircraft is described with emphasis on gas control, hydromechanical regulation, principal instrumentation, motors, the theory and choice of performance parameters, associated automatic systems, and operational procedures. Solutions currently envisioned for future AIRBUS A-310 are presented, particularly the introduction of partially electronic regulation. Transl. by A.R.H.

N80-26322# National Research Center for Energetics and Propulsion, Milan (Italy).
CONTROL OF ALTERNATIVE ENGINES BY MICROCOMPUTER SYSTEMS
C. Casci, F. M. Montevecchi, and B. Abbiati *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 9 p refs (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Development in microcomputer controlled fuel systems for internal combustion engines are discussed. Three cars - Fiat 127, Ford Fiesta and Alfa Romeo Alfasud - were provided with a microcomputer to control mixture ratio by means of floating chamber pressure regulation in the carburetor. A complex feedback control loop adjusts pressure level depending upon exhaust gases oxygen contents. Experimental testing of the device evidentiated the dependence of control system time delay upon rpm along with sensitivity to manifold geometry, sensor positioning, and related engine design details. Implemented control has taken into account rpm in relation with the forecast map of the specific engine. Tests were carried out on both at constant rev. speed and in emission tests. Engine design parameters and sensor location showed a strong influence on control system performance. Results indicated inherent limitations in control loop efficiency related to the use of exhaust sensors. The closed loop approach looks potentially capable of controlling automotive engines in the demanding future operational requisites. Progress is dependant upon improvement in air-fuel mixing techniques and in combustion sensors. M.G.

N80-26323# Lucas Aerospace Ltd., Birmingham (England).
A UNIFIED DIGITAL APPROACH TO THE CONTROL OF A DIVERSE RANGE OF ENGINES
M. J. Joby and R. D. Powell *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 12 p refs (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Digital control systems for gas turbine engines are examined in the light of the commonality of hardware and software requirements between diverse applications. Alternative control configurations for a main gas turbine engine are examined including: (1) a full hydromechanical, (2) hydromechanical with a supervisory electronic trim, (3) a full electronic with a hydromechanical backup, and (4) a full electronic with a further electronic backup. Through a consideration of the digital control unit structure for the different configurations, the commonality in hardware requirements is demonstrated. In addition, by having modules for each input and output a standard 'pack of cards' can be created from which a selection can be made for any application. Self monitoring and testing capabilities in digital systems are examined and examples from different applications are discussed, including helicopters, civil transport engines, industrial gas turbines, and military power plants. M.G.

N80-26324# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
ADVANTAGES OF THE DIGITAL TECHNOLOGY FOR THE REALIZATION OF ENGINE CONTROL SYSTEMS
G. Dahl and H. Drtil *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 8 p (For primary document

see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

Requirements to be met by the digital control units and the advantages resulting therefrom are discussed. It is shown that with respect to their capacity future digital engine control units have essential advantages (integrated engine-flight control, functions, reliability, adjustments) compared to hydromechanical and analog electronical systems. Digital control units have a higher efficiency but will probably be of the same volume than actual control units. A considerable reduction of the interface and its volume will only be possible if the environment of the digital computer is digitalized as well, that means if sensors are provided with a digital pick-up, and if a direct digital control of the actuators and the displays is available. M.G.

N80-26325# Rolls-Royce Ltd., Leaveseden (England). Aero Div.
THE DIGITAL CONTROL SYSTEM AS PART OF AN INTEGRATED ACCESSORY FIT FOR FUTURE ENGINES
M. P. Perks and T. G. Morton *In* AGARD Advan. Control Systems for Aircraft Powerplants Feb. 1980 11 p ref (For primary document see N80-26306 17-07)
Avail: NTIS HC A11/MF A01

The development of digital control systems for gas turbine engines is discussed. It is suggested that the traditional approach of designing the control system in isolation from the other accessories on a gas turbine engine may not provide the most cost effective total solution for an engine having a digital control system. It is considered that the integrity of the digital control can be maintained while providing additional functions not associated with its prime control task. This could allow the development of advanced monitoring systems to minimize life cycle costs and achieve maximum aircraft utilization. The application of these principles to helicopter engines is discussed and an arrangement proposed which could provide substantial benefits both to the helicopter pilot and to the ground crew. Pilot work-load would be substantially reduced by advising him of engine or aircraft management factors on a 'need to know' basis. Operators would benefit from regular information on the operational status of the engines. M.G.

N80-26326# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE 54TH(B) PROPULSION AND ENERGETICS PANEL MEETING ON COMBUSTOR MODELLING
David Dryburgh (Rolls Royce, Derby, England) and Raymond B. Edelman (Science Applications, Inc., Canoga Pk., Calif.) Mar. 1980 20 p Meeting held at Cologne, 3-5 Oct. 1979
(AGARD-AR-153; ISBN-92-835-1355-X) Avail: NTIS HC A02/MF A01

After a short introduction, the meeting papers are classified into categories concerning model elements, dimensionality, survey type, application and theoretical development. The first evaluation follows this classification, while other evaluations are related to the manufacturer's and the researcher's point of view. Conclusions and recommendations for future treatment of combustor modelling are presented. Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-26327*# Optimization Software, Inc., Los Angeles, Calif.
OPTIMIZATION AND SIMULATION OF FLIGHT CONTROL LAWS UNDER PARAMETER UNCERTAINTY AND EXTERNAL DISTURBANCES Final Report
1 Dec. 1979 136 p refs
(Contract NASw-3158)
(NASA-CR-163292) Avail: NTIS HC A07/MF A01 CSCL 01C

Several tasks pertinent to flight control in parameter uncertainty and wind-gust loading were successfully completed. Identification algorithms for extracting stability and control derivatives from flight data taking gust loading into account were developed. They were verified by simulation and evaluated throughly on actual flight data taken on a Lockheed Jet Star flying in turbulence. In particular the need for automatically generated dither-like inputs was studied. Criteria for performance evaluation using stochastic models were developed for gust alleviation as well as handling quantities. Algorithms for assessing degradation in performance due to parameter uncertainty were developed and evaluated using flight test data. Author

N80-26328*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
DEVELOPMENT AND FLIGHT TEST RESULTS OF AN AUTOTHROTTLE CONTROL SYSTEM AT MACH 3 CRUISE
Glenn B. Gilyard and John J. Burken Jul. 1980 40 p refs
(NASA-TP-1621; H-1090) Avail: NTIS HC A03/MF A01 CSCL 01C

Flight test results obtained with the original Mach hold autopilot designed the YF-12C airplane which uses elevator control and a newly developed Mach hold system having an autothrottle integrated with an altitude hold autopilot system are presented. The autothrottle tests demonstrate good speed control at high Mach numbers and high altitudes while simultaneously maintaining control over altitude and good ride qualities. The autothrottle system was designed to control either Mach number or knots equivalent airspeed (KEAS). Excellent control of Mach number or KEAS was obtained with the autothrottle system when combined with altitude hold. Ride qualities were significantly better than with the conventional Mach hold system. E.D.K.

N80-26329# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
INTERACTIVE DESIGN SYSTEM FOR AIRCRAFT DYNAMIC CONTROL PROBLEMS
Wolfgang J. Kubbat, G. Oesterhelt, and U. Korte 6 Sep. 1979 19 p Presented at SMP of AGARD Meeting, Neubiberg, West Germany, 3-6 Sep. 1979
(MBB-FE-324/S/Pub/11) Copyright. Avail: NTIS HC A02/MF A01

An interactive system for control law design and synthesis is described. Available methods (continuous discrete, time domain-frequency domain) are reviewed and the system is illustrated. Selection of method (i.e., discrete vs. continuous complete vs. incomplete state feedback, optimal control vs. pole-placement etc.) is followed by a dialog designer-computer with immediate results presented in numerical and graphical form (plots, print-outs). Each result is stored and can be compared with any other via dual plots. The system also allows the input of disturbance like white or colored noise, ramps, steps, sine and cosine combinations. There is no practical restriction on the number of state variables. A helicopter control problem is used to demonstrate use of the system. Author (ESA)

N80-26330# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TECHNICAL EVALUATION REPORT ON THE FLUID DYNAMICS PANEL SYMPOSIUM ON AERODYNAMIC CHARACTERISTICS OF CONTROLS
H. H. B. M. Thomas Mar. 1980 18 p refs
(AGARD-AR-157; ISBN-92-835-1351-7) Avail: NTIS HC A02/MF A01

The different ways in which active control technology can impact aircraft design and tasks facing the aerodynamist are reviewed, including the effect of aircraft configuration on relaxed stability and the effect of control integration on aerodynamics. The correlation of flight and wind tunnel control effectiveness measurements is considered as well as difficulties in predicting transonic flow and attached flow. A.R.H.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N80-26331# Yang (Nai C.) and Associates, New York, N.Y.
NONDESTRUCTIVE EVALUATION OF AIRPORT PAVEMENTS. VOLUME 3: OPERATION MANUAL FOR MLGPAV PROGRAM AT TCC
David Yang Sep. 1979 47 p
(Contract DOT-FA77WA-3984)
(AD-A079591; FAA-RD-78-154-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 01/5

Sensitivity analysis of aircraft parameters on functional pavement design is discussed. The MLGPAV program is an integrated system which is data independent based on defined mathematical models and operational logic. The input data is divided into job and universal default inputs. The job inputs consists of only the aircraft data such as: (1) forecast of aircraft movements; (2) maximum takeoff weight; (3) natural frequency of aircraft at tire pavement interface; (4) tire pressure of main landing gear wheel; (5) wheel configuration of main landing gear; and (6) gear spacing. The default system contains all of the data independent of the aircraft, such as: (1) regional cost values; (2) types of facility, runway, taxiway, apron; (3) navigation system; (4) operation speed; (5) roughness and maintenance standards; (6) subgrade conditions; and (7) airport traffic distribution. A unified mechanistic method is used to design five types of functional pavements for identical service requirements on riding quality and maintenance needs. They are: (1) asphalt pavements in southern or northern region; (2) concrete pavements on stabilized or aggregate base; and (3) full depth stabilized base pavement. J.M.S.

N80-26332# Oregon Univ., Eugene. Dept. of Psychology.
LOW COST SIMULATION OF PILOTING TASKS
Gerald M. Reicher, Brian J. Davidson, Harold L. Hawkins, and Gilbert Osgood 21 Jan. 1980 29 p refs
(Contract N00014-77-C-0643)
(AD-A080856; TR-4) Avail: NTIS HC A03/MF A01 CSCL 05/9

An attempt was made to validate a low cost, low fidelity, computer driven flight simulator. The validation is required so that the simulator can be used as a criterion task to see whether we can predict flight performance on the basis of performance on other tests of individual cognitive ability like attentional flexibility, visual representational skill, priority setting and planning. The simulator was based on instrument flying rather than visual contact flying and incorporated secondary tasks to further tax the pilot's capacity. Simulator performance is correlated with hours of flight training, the best correlations coming from conditions which impose additional task demands. GRA

N80-26333# Lockheed-California Co., Burbank.
BUILT-IN-TEST AND EXTERNAL TESTER RELIABILITY CHARACTERISTICS Final Technical Report, May 1978 - Jul. 1979
Donald E. Tuttle and Richard Loveless Mar. 1980 101 p refs
(Contract F30602-78-C-0157; AF Proj. 2338)
(AD-A083488; LR-29052; RADC-TR-80-32) Avail: NTIS HC A06/MF A01 CSCL 15/5

This report presents the results of a study of built-in-test (BIT) and external test equipment reliability impact on prime equipment design and maintenance down time. Sixty (60) units were analyzed from the S-3A, C-5A, and MK-86 weapons systems to develop BIT and external tester measurement effectiveness versus unit design characteristics. Tradeoff criteria are developed for predicting BIT and test equipment reliability during the acquisition of new systems. GRA

N80-26334# Johns-Manville Sales Corp., Denver, Colo. Research and Development Center.
HEAT RECLAMATION FROM FLIGHT SIMULATORS Final Report, 1 Sep. 1978 - Mar. 1980
P. B. Shepherd Mar. 1980 7 p
(Contract DAAK70-78-D-0002)
(AD-A081754) Avail: NTIS HC A02/MF A01 CSCL 05/9

The objective of Task Order no. 9 was to conduct a market and literature survey to determine the current state-of-the-art on heat reclamation devices for air conditioners used with flight simulators. Applicability of such devices to each flight simulator facility will be evaluated and will include energy savings, cost effectiveness, operation, maintenance, safety code compliance and product warranty limitation considerations. GRA

N80-26335# Air Force Human Resources Lab., Williams AFB, Ariz. Flying Training Div.
APPLICATION OF FLIGHT SIMULATOR RECORD/PLAYBACK FEATURE Interim Report, Jan. - May 1979
Ronald G. Hughes, Samuel T. Hannan, and William E. Jones Dec. 1979 16 p refs
(AF Proj. 1123)
(AD-A081752; AFHRL-TR-79-52) Avail: NTIS HC A02/MF A01 CSCL 05/9

Undergraduate Pilot Training (UPT) students acquired a complex visual task in ASPT under one of three instructional conditions which differed in their use of an automated record/playback feature. The study evaluated differences in performance resulting from (1) periodic, repeated use of a recorded, instructor-presented demonstration, (2) periodic use of replay of student performance, and (3) use of equivalent training time for additional practice. The data indicated little or no instructional value associated with repeated exposures to the original demonstration of the task to be learned. While the (replay) condition produced terminal performances with fewer errors on the average than the (demo) condition, differences between (practice) and (replay) groups were not statistically significant. The surprising finding of the study was the effectiveness of simple practice relative to that of the two, so-called, (instructional) conditions. These data would suggest that, at least in some instances, a training approach that provided only for basic performance feedback e.g., a (score) might be equally as effective as one with provision for presenting repeated access to recorded demonstrations and/or replays of previous performance. GRA

N80-26336# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Technical and Resources Management Div.
AERONAUTICAL SYSTEMS TECHNOLOGY NEEDS-TEST FACILITIES AND TEST EQUIPMENT Annual Report
Donald C. Kittinger Feb. 1980 56 p refs Supersedes ASD-TR-79-5039
(AD-A083553; ASD-TR-80-5011; ASD-TR-79-5039) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report is part of a compilation of formalized Technology Needs (TN) covering Equipment Subsystems as identified by the Aeronautical Systems Division. They are based on development/operational experience, system studies and new concepts - all related to future system applications. Their presentation is to serve a threefold purpose; i.e., guidance for technology program, proven development potential, and engineering data/requirements essential for technology use in systems. The identified needs delineate progress desired in performance, control, design flexibility, safety and cost. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N80-26337*# Relay Development Corp., Branford, Conn.
A SEARCH FOR EXPERIMENTS TO EXPLOIT THE SPACE SHUTTLE ENVIRONMENT, VOLUME 1 Final Report
John B. Fenn 15 Dec. 1979 70 p refs 2 Vol.
(Contracts NAS7-100; JPL-955578)
(NASA-CR-163030) Avail: NTIS HC A04/MF A01 CSCL 22A

A search for worthwhile experiments in pure and applied physics and chemistry which might take advantage of conditions

achievable aboard the space shuttle is documented. Of particular interest were the very large pumping speeds at high or ultra high vacuum, the highly nonequilibrium composition of the ambient atmosphere, and the relative absence of gravitational effects. Ideas and suggestions were solicited in the course of visits to 31 research establishments in Western Europe, India, and Japan; conversations with over 90 scientists; and presentations at 3 international meetings. Intriguing possibilities emerged in the following arenas: (1) spectroscopy of the transition state in chemical reactions; (2) flame structure and analysis; (3) solid propellant combustion; (4) analysis of atmospheric composition; (5) turbulence effects on aerosol coagulation. M.G.

N80-26338*# Relay Development Corp., Branford, Conn.
A SEARCH FOR EXPERIMENTS TO EXPLOIT THE SPACE SHUTTLE ENVIRONMENT, VOLUME 2 Final Report
John B. Fenn 15 Dec. 1979 32 p 2 Vol.
(Contracts NAS7-100; JPL-955578)
(NASA-CR-163031) Avail: NTIS HC A03/MF A01 CSCL 22A

Institutions and laboratories in India, Japan, and Western Europe which were visited during a search for experiments to exploit the space shuttle environment are described. The facilities and current research interests of the various centers are discussed with particular emphasis given to the Indian Space Research Organization. M.G.

N80-26339*# Analytical and Computational Mathematics, Inc., Houston, Tex.
MISSION ANALYSIS DATA FOR INCLINED GEOSYNCHRONOUS ORBITS, PART 1
Otis F. Graf, Jr. and K. C. Wang May 1980 81 p refs
(Contract NAS9-15883)
(NASA-CR-160702; ACM-TR-121-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 22A

Data needed for preliminary design of inclined geosynchronous missions are provided. The inertial and Earth fixed coordinate systems are described, as well as orbit parameters and elements. The complete family of geosynchronous orbits is discussed. It is shown that circular inclined geosynchronous orbits comprise only one set in this family. The major orbit perturbation and their separate effects on the geosynchronous orbit are discussed. Detailed information on the orbit perturbation of inclined circular geosynchronous orbits is given, with emphasis on time history data of certain orbital elements. Orbit maintenance delta velocity (V) requirements to counteract the major orbit perturbations are determined in order to provide order of magnitude estimates and to show the effects of orbit inclination on delta V. Some of the considerations in mission design for a multisatellite system, such as a halo orbit constellation, are discussed. E.D.K.

N80-26340* Analytical and Computational Mathematics, Inc., Houston, Tex.
MISSION ANALYSIS DATA FOR INCLINED GEOSYNCHRONOUS ORBITS, PART 2. APPENDIX A: BIBLIOGRAPHY
May 1980 50 p
(Contract NAS9-15883)
(NASA-CR-160703; ACM-TR-121-Pt-2-App-A) Avail: NTIS HC A03/MF A01 CSCL 22A

A bibliography of papers and reports on geosynchronous orbits, as well as background papers concerned with the fundamentals of orbital mechanics is presented. A listing of computer programs developed for this study is included. E.D.K.

N80-26341*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TELECOMMUNICATIONS AND DATA ACQUISITION REPORT Progress Report, Mar. - Apr. 1980
15 Jun. 1980 176 p refs
(Contract NAS7-100)
(NASA-CR-163249; JPL-Pub-42-57) Avail: NTIS HC A09/MF A01 CSCL 22A

Progress in the development and operations of the Deep Space Network is reported. Developments in Earth based radio technology as applied to geodynamics, astrophysics, and radio astronomy's use of the deep space stations for a radio search for extraterrestrial intelligence in the microwave region of the electromagnetic spectrum are reported. For individual titles, see N80-26342 through N80-26363.

N80-26342*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE: TELECOMMUNICATIONS TECHNOLOGY c17
R. E. Edelson and G. S. Levy *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 1-8 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09F

Efforts to discover evidence of intelligent extraterrestrial life have become not only feasible, but respectable. Fledgling observational projects have begun that will use state-of-the-art hardware to develop sophisticated receiving and data processing systems. The rationale behind the Search for Extraterrestrial Intelligence, the manner in which the program is taking shape, and the implications for telecommunications are described. It is concluded that the breadth of technological development required for the detection of signals from galactic brethren has particular relevance for the future of telecommunications in Earth oriented uses. E.D.K.

N80-26343*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SETI OBSERVATIONAL PLAN c32
A. L. Berman *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 43-49 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

The SETI (Search for Extraterrestrial Intelligence) Project's primary thrust is to search the microwave region of the spectrum for signals of extraterrestrial intelligent origin. The project will search a well defined volume of search parameter space using existing antennae and a sophisticated data acquisition and analysis system. Two major components are included, the target survey, which will observe at very high sensitivity all attractive stellar candidates within 75 light years of the Sun, and the sky survey, which will observe the entire celestial sphere at a lower sensitivity. E.D.K.

N80-26344*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ERROR ESTIMATION FOR ORION BASELINE VECTOR DETERMINATION c32
S. C. Wu *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 16-31 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

Effects of error sources on Operational Radio Interferometry Observing Network (ORION) baseline vector determination are studied. Partial derivatives of delay observations with respect to each error source are formulated. Covariance analysis is performed to estimate the contribution of each error source to baseline vector error. System design parameters such as antenna sizes, system temperatures and provision for dual frequency operation are discussed. E.D.K.

N80-26345*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 32-34 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized. Deep Space Station, ground communication, and network operations control capabilities are described. E.D.K.

N80-26346*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN COMMAND SYSTEM MARK III-80 c32
H. C. Thorman *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 35-42 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

The Deep Space Network command system configuration

and functional operation are described. Voyager and Helios command operations are supported with Deep Space Station store and forward data handling; Viking and Pioneer are supported with the older, near real time data handling method. Author

N80-26347*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEER VENUS MULTIPROBE ENTRY TELEMETRY RECOVERY c17
R. B. Miller and R. Ramos (NASA. Ames Res. Center) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 43-49 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09F

The entry phase of the Pioneer Venus Multiprobe Mission involved data transmission over a two hour span. The criticality of recovering those two hours of data, coupled with the fact that there were no radio signals from the probes until their arrival at Venus, dictated unique telemetry recovery approaches on the ground. The result was double redundancy, use of spectrum analyzers to aid in rapid acquisition of the signals, and development of a technique for recovery of telemetry data without the use of real time coherent detection, which is normally employed for all other planetary missions. E.D.K.

N80-26348*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER MISSION SUPPORT c15
N. Fanelli and H. Nance *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 50-53 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

Special events participated in by the Deep Space Stations (DSS) for the period of February through April 1980 are presented. The status of the DSS is reviewed for the same period, including system performance tests and operational verification tests. A list of software accepted for operation at the DSS is given. E.D.K.

N80-26349*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERNATIONAL SOLAR POLAR MISSION SUPPORT c15
R. B. Miller *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 54-57 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

The primary objective of the International Solar Polar Mission (ISPM) is to investigate solar and interplanetary phenomena as a function of the solar latitude. The mission is to be accomplished by using a gravity assist at the planet Jupiter to send two spacecraft out of the ecliptic plane. Available trajectory information is supplied, and spaceborne experiments under consideration are discussed. An introduction to the key characteristics of both spacecraft is given, emphasizing communication equipment. E.D.K.

N80-26350*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING ORBITER COMPLETION MISSION AND VIKING LANDER MONITOR MISSION c91
R. L. Gillette *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 58-61 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 03B

A brief history of the Viking Missions is presented. The status of the present Viking Orbiter and Landers for the period from February 1, 1980 through March 31, 1980 is discussed, with emphasis on data transmission abilities. E.D.K.

N80-26351*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A THEORETICAL MODEL OF PHASE CHANGES OF A KLYSTRON DUE TO VARIATION OF OPERATING PARAMETERS c33
A. Kupiszewski *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 62-64 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

A mathematical model for phase changes of the VA-876 CW klystron amplifier output is presented and variations of several operating parameters are considered. The theoretical approach to the problem is based upon a gridded gap modeling with inclusion of a second order correction term so that actual gap geometry is reflected in the formulation. Physical measurements are contrasted to theoretical calculations. Author

N80-26352*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE 64 METER ANTENNA OPERATION AT K SUB A BAND c32
P. D. Potter *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 65-70 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

The future potential of the 32 GHz K sub A band frequency region to planetary exploration, and the expected performance of the 64 m antenna network at 32 GHz is addressed. A modest level of noninterference upgrade work is assumed to achieve reasonable antenna aperture efficiency and alleviate antenna pointing difficulties. Electronic compensation of antenna aperture phasing errors is briefly considered as an alternative to the physical upgrade. E.D.K.

N80-26353*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH-POWER TRANSMITTER AUTOMATION c33
R. Gosline *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 71-81 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

The current status of the transmitter automation development applicable to all transmitters in the deep space network is described. Interface and software designs are described that improve reliability and reduce the time required for subsystem turn-on and klystron saturation to less than 10 minutes. M.G.

N80-26354*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RFI RECEIVER c32
R. Lay *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 82-86 *ref* (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

An S-band radio frequency interference (RFI) receiver to analyze and identify sources of RFI problems in the Deep Space Network DSN tracking stations is described. The RFI receiver is a constant gain, double conversion, open loop receiver with dual sine/cosine channel outputs, providing a total of 20 MHZ monitoring capability. This receiver is computer controlled using a MODCOMP II miniprocessor. The RFI receiver has been designed to operate at a 150 Kelvin system noise temperature accomplished by cascading two low noise field effect transistor (FET) amplifiers for the receiver front-end. The first stage low noise FET amplifier is mounted at the feed horn to minimize any cable losses to achieve a lower system noise temperature. The receiver is tunable over the frequency range of 2150 to 2450 MHz in both sine/cosine output channels with a resolution of 100 kHz. M.G.

N80-26355*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ON THE APPLICATION OF A FAST POLYNOMIAL TRANSFORM AND THE CHINESE REMAINDER THEOREM TO COMPUTE A TWO-DIMENSIONAL CONVOLUTION c64
T. K. Truong, R. Lipes, I. S. Reed (Univ. of Southern California), and C. Wu *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 87-102 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 12A

A fast algorithm is developed to compute two dimensional convolutions of an array of d sub 1 X d sub 2 complex number points, where d sub 2 = 2(M) and d sub 1 = $2(m-r+)$ for some $1 < or = r < or = m$. This algorithm requires fewer multiplications and about the same number of additions as the conventional fast fourier transform method for computing the two dimensional convolution. It also has the advantage that the

operation of transposing the matrix of data can be avoided.
Author

N80-26358*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEEP SPACE STATION (DSS-13) AUTOMATION DEMONSTRATION c14
D. S. Remer and G. Lorden (California Inst. of Technology) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 103-119 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

The data base collected during a six month demonstration of an automated Deep Space Station (DSS 13) run unattended and remotely controlled is summarized. During this period, DSS 13 received spacecraft telemetry data from Voyager, Pioneers 10 and 11, and Helios projects. Corrective and preventive maintenance are reported by subsystem including the traditional subsystems and those subsystems added for the automation demonstration. Operations and maintenance data for a comparable manned Deep Space Station (DSS 11) are also presented for comparison. The data suggests that unattended operations may reduce maintenance manhours in addition to reducing operator manhours. Corrective maintenance for the unmanned station was about one third of the manned station, and preventive maintenance was about one half. M.G.

N80-26357*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SYNCHRONIZATION OF REED-SOLOMON CODES c17
R. L. Miller and R. B. Newman (California Inst. of Technology) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 120-122 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09F

The synchronization capabilities of Reed-Solomon codes when an appropriate coset of the code is used instead of the code itself are examined. In this case an E-error correcting Reed-Solomon code is transformed into a code capable of determining that there are m symbols out of sync, if e symbol errors occurred, whenever $m + e < E$. In the event that $m = 0$, i.e., the word is in sync, then decoder will correct any pattern of $E - 1$ on fewer symbol errors. M.G.

N80-26358*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STRESS DISTRIBUTION IN A SEMI-INFINITE BODY SYMMETRICALLY LOADED OVER A CIRCULAR AREA c39
H. McGinness *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 123-130 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20K

Algorithms are developed for computing stresses in a semi-infinite body when loaded by a uniform pressure acting over a circular area. The algorithm allows easy determination of any stress component in a semi-infinite body having a known Poisson's ratio. Example curves are plotted for Portland cement grout and metal representative values. M.G.

N80-26359*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPTIMAL PERIODIC BINARY CODES OF LENGTHS 28 TO 64 c61
S. Tyler and R. Keston *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 131-135 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09B

Results from computer searches performed to find repeated binary phase coded waveforms with optimal periodic autocorrelation functions are discussed. The best results for lengths 28 to 64 are given. The code features of major concern are where (1) the peak sidelobe in the autocorrelation function is small and (2) the sum of the squares of the sidelobes in the autocorrelation function is small. M.G.

N80-26360*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
UTILIZATION OF THE VENUS STATION (DSS 13) 26 METER ANTENNA DURING CY 1979 c32
E. B. Jackson *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 136 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

The various activities for which the Venus Station's 26 m antenna was used are described and the number of manned tracking hours devoted to each activity are given. A brief description of the goal of each activity supported is provided, and, where appropriate, the observing technique is summarized. Projects involving spacecraft tracking, advanced systems development, and radio astronomy are included. M.G.

N80-26361*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DATA ACQUISITION FOR MEASURING THE WIND ON VENUS FROM PIONEER VENUS c91
J. R. Smith and R. Ramos (NASA. Ames Res. Center) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 140-149 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 03B

The data acquisition and processing techniques used in the Pioneer Venus differential long baseline interferometry experiment are discribed. The experiment was designed to measure the motion in three dimensions of the Pioneer probes during their fall to the surface of Venus, using a combination of Doppler and long baseline ratio interferometric methods. The design of the experiment and the equipment and software techniques that were developed specially for this experiment are also described. M.G.

N80-26362*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLANETARY RADAR c89
R. M. Taylor and G. S. Downs *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 150 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 03A

The radar astronomy activities supported by the Deep Space Network are reported. The high power S- and X-band radar transmitters at the Goldstone 64 meter station were used for a radar probe of Mars during January, February, and March 1980, which was designed to provide range and Doppler data derived from signals reflected from the Martian surface, taking advantage of the planet's nearness during opposition. M.G.

N80-26363*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A SURVEY OF NUMERICAL MODELS FOR WIND PREDICTION c47
D. Schonfeld *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 151-170 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 04B

A literature review is presented of the work done in the numerical modeling of wind flows. Pertinent computational techniques are described, as well as the necessary assumptions used to simplify the governing equations. A steady state model is outlined, based on the data obtained at the Deep Space Communications complex at Goldstone, California. Author

N80-26364*# Martin Marietta Corp., Denver, Colo.
COMET NUCLEUS IMPACT PROBE FEASIBILITY STUDY Final Report
Angelo J. Castro 15 Apr. 1980 69 p refs
(NASA Order A-71116-B)
(NASA-CR-152375; MCR-80-1002) Avail: NTIS HC A04/MF A01 CSCL 22A

A top level listing of the comet nucleus impact probe (CNIP) feasibility experiments requirements are presented. A conceptual configuration which shows that the feasibility of engineering the experiment is possible and describes the candidate hardware is discussed. The design studies required in order to design the operating experiment are outlined. An overview of a program plan used to estimate a rough order of magnitude cost for the CNIP experiment is given. E.D.K.

N80-26365*# Rockwell International Corp., Downey, Calif.
SPACE PLATFORM UTILITIES DISTRIBUTION STUDY
A. E. LeFever Jul. 1980 84 p refs

(Contract NAS1-15322)
(NASA-CR-159272) Avail: NTIS HC A05/MF A01 CSCL 22A

Generic concepts for the installation of power data and thermal fluid distribution lines on large space platforms were discussed. Connections with central utility subsystem modules and pallet interfaces were also considered. Three system concept study platforms were used as basepoints for the detail development. The tradeoff of high voltage low voltage power distribution and the impact of fiber optics as a data distribution mechanism were analyzed. Thermal expansion and temperature control of utility lines and ducts were considered. Technology developments required for implementation of the generic distribution concepts were identified. B.D.

N80-26368*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
SPACE ASSEMBLY FIXTURES AND AIDS Final Report
K. A. Bloom and A. N. Lillenas Jul. 1980 198 p refs
(Contract NAS1-15322)
(NASA-CR-159285; SSD-80-0021) Avail: NTIS HC A09/MF A01 CSCL 22A

Concepts and requirements for assembly fixtures and aids necessary for the assembly and maintenance of spare platforms were studied. Emphasis was placed on erectable and deployable type structures with the shuttle orbiter as the assembly base. Both single and multiple orbiter flight cases for the platform assembly were considered. Applicable space platform assembly studies were reviewed to provide a data base for establishing the assembly fixture and aids design requirements, assembly constraints, and the development of representative design concepts. Conclusions indicated that fixture requirements will vary with platform size. Larger platforms will require translation relative to the orbiter RMS working volume. The installation of platform payloads and subsystems (e.g., utility distribution) must also be considered in the specification of assembly fixtures and aids. Author

N80-27248# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
PRESENT STATE AND FUTURE OF THE SCIENTIFIC SPACE PROGRAM OF THE FEDERAL REPUBLIC OF GERMANY
W. Regula *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 205-217 In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-26367# Range Commanders Council, White Sands Missile Range, N. Mex. Meteorological Group.
RANGE ATMOSPHERIC AND OCEANIC ENVIRONMENTAL SUPPORT CAPABILITIES / REQUIREMENTS / PROCUREMENTS
1980 222 p Supersedes MG-125-72
(AD-A082755; RCC/MG-125-80; MG-125-72) Avail: NTIS HC A10/MF A01 CSCL 04/2

Discussed are range natural atmospheric and oceanic environmental support capabilities/requirements, which must be known both to satisfy present needs and for long-range planning to meet projected needs. The identification of planned procurements, and equipment excess to requirements will foster exchanges, transfers, joint procurements and the cost savings to all member ranges. This document represents a current identification of those capabilities/requirements/procurements. It supersedes IRIG Document 125-72 which is obsolete and should be destroyed. GRA

N80-26345*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 32-34 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N80-26356*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEEP SPACE STATION (DSS-13) AUTOMATION DEMONSTRATION
D. S. Remer and G. Lorden (California Inst. of Technology) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 103-119 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-26388# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A REVIEW OF SATELLITE LIFETIME AND ORBIT DECAY PREDICTION
J. deLafontaine and S. C. Garg Jun. 1980 81 p refs Sponsored by Canada Dept. of Communication
(UTIAS-43; ISSN-0082-5247) Avail: NTIS HC A05/MF A01

The modelling and the methods necessary to predict satellite lifetimes are reviewed. Orbital perturbations, models for Earth's potential field, luni-solar attraction and atmospheric drag are considered. Static and dynamic density models are presented. Satellite properties (projected area and drag coefficient) are discussed. Analytical methods for using these models are examined and compared with other methods. The state of the art is assessed and areas requiring more research are identified. A.R.H.

N80-26389# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Dept. Etudes Speciales.
A MAGNETIC SUSPENSION WITH PASSIVE RADIAL CENTERING FOR SATELLITE FLYWHEEL AND KINETIC ENERGY STORAGE SYSTEMS
P. C. Poubeau Paris 1979 23 p refs Presented at 3d Intern. Workshop on Rare Earth-Colbalt Permanent Magnets and their Appl., San Diego, Calif., 27-30 Jun. 1978 Sponsored by Intern. Telecommun. Satellite Organ., ESA, and CNES
(SNIAS-792-422-111) Avail: NTIS HC A02/MF A01

The overall concept of satellite flywheels is described as well as their rotor magnetic suspension and associated subsystems. The possible evolution of such equipment towards kinetic energy storage systems which could be utilized for satellite as well as for ground applications in a wide range of rotation speeds is examined. Author (ESA)

N80-26370# Stuttgart Univ. (West Germany). Inst. fuer Kernenenergetik und Energiesysteme.
LIFETESTS OF TELECOMMUNICATIONS SATELLITE HEAT PIPES Final Report
W. D. Muenzel Jan. 1979 81 p refs
(Contract ESA-1857/73-JS)
(ESA-CR(P)-1312) Avail: NTIS HC A05/MF A01

The life testing of low temperature heat pipes designed for satellite thermal control is discussed. Five stainless steel/ammonia artery heat pipes and four aluminum/ammonia artery heat pipes were operated at elevated temperatures of about 60 C with a heat load of 15 watts for each pipe. In addition, two axially grooved aluminum/ammonia heat pipes operating at 60 C with a heat load of 50 watts, each were tested. Major results obtained from controlled maximum performance tests are compiled. Moreover, the results of some mechanical tests, burst pressure tests, and a post-mortem analysis of one of the aluminum artery heat pipes are included. Life testing of stainless steel heat pipes indicates no signs of deterioration over a period of three years. The aluminum heat pipes develop a steadily increasing amount of non condensible gas. However, life testing of axially grooved aluminum heat pipes show that the small amounts of non condensible gas generated after a period of nearly one year, produce little effect on the heat transport characteristics of these pipes. M.G.

N80-26371# British Aerospace Dynamics Group, Stevenage (England).
PALLET-ONLY CONFIGURATION IMPROVEMENT STUDY-RIDER: TECHNICAL STUDY Final Report
B. Collins, comp. Nov. 1979 77 p refs
(Contract ESA-3608/78)
(BAE-TPD-7761; ESA-CR(P)-1315) Avail: NTIS HC A05/MF A01

Two systems, (1) free-flying pallets connected to the NASA power module and (2) autonomous free-flying pallet, are examined in more detail. A background description of each system is given. Thermal control options are reviewed for the first system along with the feasibility of assembling longer pallet trains. For the second system aspects of the attitude and orbit control system, the thermal control system, and the command and data management system are considered. The study shows that Coastal Oceans Monitoring Satellite can be accommodated by the second system using a half-pallet. Author (ESA)

N80-26372# Royal Aircraft Establishment, Farnborough (England).
TABLE OF EARTH SATELLITES. VOLUME 3: 1974 TO 1978
J. A. Pilkington, D. G. King-Hele, H. Hiller, and Doreen M. C. Walker London HMSO Jan. 1980 220 p refs
(RAE-TR-80001; RAE-Space-573; BR72771) Avail: NTIS HC A10/MF A01

The 607 Earth satellite launches are arranged chronologically, giving the name and international designation of each instrumented satellite and its associated rocket(s), with the date of launch, lifetime (actual or estimated), mass, shape, dimensions and at least one set of orbital parameters. Other fragments associated with a launch are listed, without details. Author (ESA)

N80-26348*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER MISSION SUPPORT
N. Fanelli and H. Nance *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 50-53 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N80-26349*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERNATIONAL SOLAR POLAR MISSION SUPPORT
R. B. Miller *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 54-57 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N80-26373*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMAL PERFORMANCE OF A MECHANICALLY ATTACHED ABLATOR TILE FOR ON-ORBIT REPAIR OF SHUTTLE TPS
Stephen S. Thompkins, Claud M. Pittman, and Albert B. Stacey, Jr. May 1980 51 p refs
(NASA-TM-81822) Avail: NTIS HC A04/MF A01 CSCL 22B

The reusable surface insulation (RSI) material used in the shuttle thermal protection system is susceptible to damage. If any RSI tiles are damaged or lost during ascent, they must be repaired or replaced prior to entry. One approach to replacing a damaged or missing RSI tile consists of mechanically attaching a tile of ablation material in the place of the RSI tile. The thermal performance of this type of repair tile was evaluated in a simulated entry heating environment. The test specimen consisted of the ablator repair tile mechanically fastened to the strain isolation pad and surrounded by RSI tiles. The evaluation of the thermal performance was based on temperature response, surface integrity, and predicted flight performance. When the ablator tile protruded 1/8 inch above the surrounding RSI tiles, the forward facing steps caused significant inflow of hot gas down the ablator RSI joints and this inflow caused greatly increased back surface temperatures. E.D.K.

N80-26374*# Boeing Commercial Airplane Co., Seattle, Wash.
TECHNOLOGY REQUIREMENTS FOR FUTURE EARTH-TO-GEOSYNCHRONOUS ORBIT TRANSPORTATION SYSTEMS. VOLUME 2: TECHNICAL RESULTS Final Report
Vincent A. Caluori Jun. 1980 247 p refs
(Contract NAS1-15301)
(NASA-CR-3266) Avail: NTIS HC A11/MF A01 CSCL 22A

Technologies either critical to performance of offering cost advantages compared to the investment required to bring them to usable confidence levels are identified. A total transportation system is used as an evaluation yardstick. Vehicles included in the system are a single stage to orbit launch vehicle used in a priority cargo role, a matching orbit transfer vehicle, a heavy lift launch vehicle with a low Earth orbit delivery capability of 226,575 kg, and a matching solar electric cargo orbit transfer vehicle. The system and its reference technology level are consistent with an initial operational capability in 1990. The 15 year mission scenario is based on early space industrialization leading to the deployment of large systems such as power satellites. Life cycle cost benefits in discounted and undiscounted dollars for each vehicle, technology advancement, and the integrated transportation system are calculated. A preliminary functional analysis was made of the operational support requirements for ground based and space based chemical propulsion orbit transfer vehicles. E.D.K.

N80-26375*# ARO, Inc., Arnold Air Force Station, Tenn.
HEAT-TRANSFER TESTS OF THE NASA/ROCKWELL INTERNATIONAL SPACE SHUTTLE ORBITER OH-84 B, IH-102 AND OH-105 Final Report, 2-23 May 1979
K. W. Nutt, G. L. Dommerman, and A. C. Mansfield AEDC Aug. 1979 109 p
(NASA-CR-163288; AD-A083142; AEDC-TSR-79-V42) Avail: NTIS HC A06/MF A01 CSCL 22/2

Heat transfer tests were conducted on two 0.0175 scale and one 0.04 scale models of the space shuttle orbiter using the thin skin thermocouple technique. Data were recorded at Mach numbers 3 and 4 in the AEDC-VKF Supersonic Wind Tunnel A and at Mach 8 in the Hypersonic Tunnel B. Ten model configurations were tested including each orbiter model and the two 0.0175 scale models integrated with the external tank and both solid rocket boosters. The objective of the test was to obtain heating data in regions of the orbiter where no previous data exist or where data extrapolation was not feasible. The model angle of attack ranged from -40 to 40 degrees with yaw angles varying from -15 to 10 degrees. GRA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N80-26342*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE: TELECOMMUNICATIONS TECHNOLOGY
R. E. Edelson and G. S. Levy *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 1-8 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09F

N80-26347*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEER VENUS MULTIPROBE ENTRY TELEMETRY RECOVERY
R. B. Miller and R. Ramos (NASA, Ames Res. Center) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 43-49 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09F

N80-26357*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SYNCHRONIZATION OF REED-SOLOMON CODES
R. L. Miller and R. B. Newman (California Inst. of Technology) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 120-122 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-26376*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DISCUSSION MEETING ON GOSSAMER SPACECRAFT (ULTRALIGHTWEIGHT SPACECRAFT) Final Report
Roy G. Brereton, ed. 15 May 1980 186 p refs Meeting held at Pasadena, Calif., 19-20 Dec. 1979
(Contract NAS7-100)
(NASA-CR-163275; JPL-Pub-80-26) Avail: NTIS HC A09/MF A01 CSCL 22B

Concepts, technology, and application of ultralightweight structures in space are examined. Gossamer spacecraft represented a generic class of space vehicles or structures characterized by a low mass per unit area (approximately 50g/sq m). Gossamer concepts include the solar sail, the space tether, and various two and three dimensional large lightweight structures that were deployed or assembled in space. The Gossamer Spacecraft had a high potential for use as a transportation device (solar sail), as a science instrument (reflecting or occulting antenna), or as a large structural component for an enclosure, manned platform, or other human habitats. Inflatable structures were one possible building element for large ultralightweight structures in space. B.D.

N80-26377*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ATM-CMG CONTROL SYSTEM STABILITY
W. W. Anderson, L. M. Avis, and K. L. Jacobs May 1980 75 p refs
(NASA-TM-81827) Avail: NTIS HC A04/MF A01 CSCL 22B

Stability analyses and simulation data and results are presented for an initial Control Moment Gyroscope system proposed for the Apollo Telescope Mount cluster (later named Skylab) using momentum vector feedback. A compensation filtering technique is presented which significantly improved analytical and simulation performance of the system. This technique is quite similar to the complementary filtering technique and represents an early NASA application. Author

N80-26378*# California Univ., San Diego, La Jolla. Space Physics Group.
ACTIVE EXPERIMENTS IN MODIFYING SPACECRAFT POTENTIAL: RESULTS FROM ATS-5 AND ATS-6 Final Report, May 1977 - Feb. 1979
R. C. Olsen and E. C. Whipple Mar. 1979 159 p refs
(Contract NASS-23481)
(NASA-CR-159993; UCSD-SP-79-01) Avail: NTIS HC A08/MF A01 CSCL 22B

The processing of data from onboard spacecraft instruments are described. The modification of spacecraft potentials is reviewed. Analysis of this data yielded the following results: (1) electron emission (E approximately < 10 electron-volts) did not perturb the status of a satellite at low potential the absolute value of phi approximately < 50 volts by more than 50 volts (the ATS 5 low energy limit), (2) emission of a low energy plasma (E approximatey < 10 volts) does not change low potentials (the absolute value of phi approximately < 5 volts) by more than a few volts (ATS 6 low energy resolution), (3) when ATS 6 entered eclipse in the presence of a high energy plasma (10 keV), the neutralizer suppressed any rise in the absolute value of phi (within a few volts resolution), (4) when the electron emitter on ATS 5 operated, it served to discharge negative potentials from thousands to hundreds of volts, and (5) when the neutralizer on ATS 6 was operated, it served to discharge kilovolt potentials to below 50 volts. Low altitude (100 - 300 km) experiments with KV electron beams are studied. Differential charging was eliminated by the operation of the main thruster on ATS 6 clamped on the spacecraft at -5 volts. B.D.

N80-26379*# National Aeronautics and Space Administration, Washington, D. C.
WITHOUT TABLES OF RANKS AND THE ISKRA STUDENT DESIGN BUREAU
N. Grigoryeva and B. Pankratov Jul. 1980 18 p Transl. into ENGLISH from 'Bez Tabeli o Rangakh' and 'SKB Iskra', Radio (USSR), no. 1, Jan. 1979 p 9-12 Transl. by Scientic Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76277) Avail: NTIS HC A02/MF A01 CSCL 22B

A brief overview of the development of ham radio Earth satellites in the Soviet Union is given. Emphasis is placed on the design and operation of the small man made satellites. For individual titles, see N80-26380 through N80-26381.

N80-26380*# National Aeronautics and Space Administration, Washington, D. C.
WITHOUT A TABLE OF RANKS: PRESENTING THE CREATORS OF RADIO-1 AND RADIO-2
N. Grigoryeva *In its* Without Tables of Ranks and the Iskra Student Design Bureau (NASA-TM-76277) Jul. 1980 p 1-23 Transl. into ENGLISH from "Bez Tabeli o Rankh", Radio (USSR), no. 1, Jan. 1979 p 9-11 (For primary document see N80-26379 17-18)
Avail: NTIS HC A02/MF A01 CSCL 22B

The design and operation of ham radio operator satellites is discussed. Major emphasis is placed on the personalities involved in the project. J.M.S.

N80-26381*# National Aeronautics and Space Administration, Washington, D. C.
SKB ISKRA
B. Pankratov *In its* Without Tables of Ranks and the Iskra Student Design Bureau (NASA-TM-76277) Jul. 1980 p 13-16 Transl. into ENGLISH from 'SKB Iskra', Radio (USSR), no. 1,

Jan. 1979 p 11-12 (For primary document see N80-26379 17-18)
Avail: NTIS HC A02/MF A01 CSCL 22B

The design and construction of small size man made Earth satellites for scientific research and scholarly purposes is reviewed. All stages of the work organization, from design to launching of a satellite, are covered. J.M.S.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-26382*# Old Dominion Univ. Research Foundation, Norfolk, Va.
ANALYSIS OF THE RIM INERTIAL MEASURING SYSTEM (RIMS) Progress Report, 21 Oct. 1979 - 21 Feb. 1980
S. M. Joshi May 1980 29 p refs
(Contract NAS1-15648)
(NASA-CR-159270) Avail: NTIS HC A03/MF A01 CSCL 17G

Nonlinear equations of motion are derived for the rim inertial measuring system, which is mounted in a strapped down configuration on a carrier vehicle. The measurement and equations derived from angular rates and linear accelerations were interfaced with the dynamic model of a user defined carried vehicle. Two methods are presented for rate measurement, and the results of the nonlinear computer simulation are presented. B.D.

N80-26383# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
THE PRECIPITATION ELECTRON DETECTORS (SSJ/3) FOR THE BLOCK 5D/FLIGHTS 2-5 DMSP SATELLITES CALIBRATION AND DATA PRESENTATION Interim Report
D. A. Hardy, M. S. Gussenhoven (Boston Coll.), and A. Huber (Emmanuel Coll.) 14 Sep. 1979 52 p refs
(AF Proj. 7601)
(AD-A083136; AFGL-TR-79-0210; AFGL-IP-282) Avail: NTIS HC A04/MF A01 CSCL 22/2

In addition to weather monitoring devices, the Defense Meteorological Satellite Program satellites currently have on-board auroral imaging devices, precipitating electron detectors, and thermal plasma analyzers. Together these provide a strong tool for analyzing the high latitude, near Earth, magnetospheric environment. The precipitating electrons are measured in 16 energy channels spanning an energy of 50 eV to 20 keV. The data have the potential of providing real-time monitoring of auroral activity through oval boundary measurements. It contains the following: a general description of the DMSP-F2 orbit, its variations in universal time and season, and the pertinence of these variations to boundary measurements, a description of the SSJ/3 pakcage, one of which is built for each of four DMSP satellites and the results of calibrating two of the instruments; a discussion of the way data is processed; a comparison of Northpole-Southpole passes during a magnetospherically quiet period and during an active period, and a discussion of the general features of the electron precipitation as they may be used to determine auroral boundaries. GRA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-26384*# National Aeronautics and Space Administration, Washington, D. C.
SPATIAL MOTION WITHOUT MATERIAL PROPULSION
A. Fenioux Mar. 1980 10 p Transl. into ENGLISH from the French Patent (Appl. no. 79/18601, 18 Jul. 1979) p 1-7 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75833) Avail: NTIS HC A02/MF A01 CSCL 21C

The retrograde system of a space vehicle is described which permits motion in space without the projection of gas by rotor or jet engine. It is composed of masses, which accelerate, decelerate and guide the center of gravity in space in an ordered actuation. The invention may be used to replace rotors and jet engines of our present space vehicles. In space, it may use electrical solar energy and develop indefinitely in the solar system. A.R.H.

N80-26385# Naval Surface Weapons Center, Dahlgren, Va.
ROCKET MOTOR BLAST EFFECTS AND PROPOSED ABLATIVE PROTECTION FOR RAM LAUNCHING SYSTEM EX 43, ADDENDUM Final Report
Earl E. Biermann and Allen B. Coates Apr. 1980 18 p
(AD-A083315; NSWC/TR-80-94) Avail: NTIS HC A02/MF A01 CSCL 16/1

The results of the flyaway and environmental tests of ablative materials described in this report show that (1) all of the materials tested are satisfactory for use in the RAM launching system and (2) Dow Corning 93-104 w/graphite is an acceptable adhesive for bonding of the recommended materials to the launcher and/or deck surface. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-26386*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREPARATION OF PERFLUORINATED IMIDOYLAMIDOXIMES Patent Application
Reinhold H. Kratzer (Ultrasystems, Inc., Irvine, Calif.), Kazimiera J. L. Paciorek (Ultrasystems, Inc., Irvine, Calif.), Thomas I. Ito (Ultrasystems, Inc., Irvine, Calif.), and Robert W. Rosser, inventors (to NASA) Filed 27 Jun. 1980 8 p
(NASA-Case-ARC-11267-1; US-Patent-Appl-SN-163839) Avail: NTIS HC A02/MF A01 CSCL 07C

A method of preparing perfluorinated imidoylamidoximes is disclosed. The imidoylamidoximes are synthesized by the condensation of a perfluorinated nitrile with a perfluorinated amidoxime in vacuo or in an inert atmosphere at a temperature within the range of about 20 to 70 C for a period of 24 to 240 hours. When both the nitrile and the amidoxime reactants are difunctional, oligomeric or polymeric product are obtained, which, after cyclization of the imidoylamidoxime groups to 1,2,4-oxadiazole linkages, yield excellent heat, chemical, and solvent resistant elastomers. NASA

N80-26387# Vacuumschmelze G.m.b.H., Hanau (West Germany).
DEVELOPMENT OF SOFT MAGNETIC MATERIALS WITH SPECIAL PROPERTIES Final Report
Albrecht Mager Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 167 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-32) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 34,65

Results on the influence of crystal grains, inclusions, and mechanical stresses on the soft magnetic properties of Ni-Fe alloys are given. Soft magnetic alloys were developed and improved for low temperature applications, for small temperature coefficients, for different shapes of hysteresis loops, and for high wear resistance. Author (ESA)

24 COMPOSITE MATERIALS

Includes laminates.

N80-26388* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CORK-RESIN ABLATIVE INSULATION FOR COMPLEX SURFACES AND METHOD FOR APPLYING THE SAME Patent

Hill M. Walker, Max H. Sharpe, and William G. Simpson, inventors (to NASA) Issued 27 May 1980 3 p Filed 12 Sep. 1978 Supersedes N78-32190 (16 - 23, p 3052)
(NASA-Case-MFS-23626-1; US-Patent-4,204,899; US-Patent-Appl-SN-941711; US-Patent-Class-156-212; US-Patent-Class-156-213; US-Patent-Class-156-285; US-Patent-Class-264-118; US-Patent-Class-264-119; US-Patent-Class-264-124; US-Patent-Class-260-17.2) Avail: US Patent and Trademark Office CSCL 11D

A method of applying cork-resin ablative insulation material to complex curved surfaces is disclosed. The material is prepared by mixing finely divided cork with a B-stage curable thermosetting resin, forming the resulting mixture into a block, B-stage curing the resin-containing block, and slicing the block into sheets. The B-stage cured sheet is shaped to conform to the surface being insulated, and further curing is then performed. Curing of the resins only to B-stage before shaping enables application of sheet material to complex curved surfaces and avoids limitations and disadvantages presented in handling of fully cured sheet material.

Official Gazette of the U.S. Patent and Trademark Office

N80-26389*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A SILICON-SLURRY/ALUMINIDE COATING Patent Application

D. L. Deadmore and S. G. Young, inventors (to NASA) Filed 20 Jun. 1980 11 p
(NASA-Case-LEW-13343-1; US-Patent-Appl-SN-161254) Avail: NTIS HC A02/MF A01 CSCL 11D

A low cost coating is disclosed which protects metallic base system substrates from high temperatures, high gas velocity oxidation, thermal fatigue and hot corrosion. The coating is particularly useful for protecting vanes and blades in aircraft and land based gas turbine engines. A lacquer slurry comprising cellulose nitrate containing high purity silicon powder is sprayed onto the superalloy substrates. The silicon layer is then aluminized to complete the coating. The Si-Al coating is less costly to produce than advanced aluminides and protects the substrate from oxidation and thermal fatigue for a much longer period of time than the conventional aluminide coatings. While more expensive Pt-Al coatings and physical vapor deposited MCrALY coatings on certain superalloys in high gas velocity oxidation and thermal fatigue. Also, the Si-Al coating increased the resistance of certain superalloys to hot corrosion. NASA

N80-26390*# National Aeronautics and Space Administration, Washington, D. C.

FURTHER DEVELOPMENT AND APPLICATION OF POLYCRYSTALLINE METAL WHISKERS

Hermann J. Schladitz Dec. 1979 61 p Transl. into ENGLISH of Weiterentwicklung und Anwendung von Polykristallinen Metallwhiskern (Bonn), Final Report, BMFT-FB-T-76-18, Jun. 1976 75 p Translation was announced as N77-12219 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Bundesministerium fuer Forsch. und Technol., Bonn
(Contract NASw-3198)
(NASA-TM-75745; BMFT-FB-T-76-18) Avail: NTIS HC A04/MF A01 CSCL 11D

High strength metal whiskers have a larger versatile field of application than monocrystalline whiskers. Although polycrystalline metal whiskers can be used for composites, preferably by extrusion in thermoplastics or by infiltration of resins or metals into whisker networks, the chief application at present may be the production and various use of whisker networks. Such networks can be produced up to high degrees of porosity and besides high mechanical strength, they have high inside surfaces and high electric conductivity. There are for instance, applications concerning construction of electrodes for batteries and fuel cells, catalysts and also new heat-exchanger material, capable of preparing fuel oil and gasoline in order to assist a high-efficiency combustion. The technical application of polycrystalline metal whiskers require their modification as well as the construction of a pilot production unit. Author

N80-26391*# Little (Arthur D.), Inc., Cambridge, Mass.

AN ASSESSMENT OF THE RISK ARISING FROM ELECTRICAL EFFECTS ASSOCIATED WITH THE RELEASE OF CARBON FIBERS FROM GENERAL AVIATION AIRCRAFT FIRES

Donald Rosenfield and Joseph Fiksel Feb. 1980 104 p
(Contract NAS1-15380)
(NASA-CR-159206) Avail: NTIS HC A06/MF A01 CSCL 11D

A Poisson type model was developed and exercised to estimate the risk of economic losses through 1993 due to potential electric effects of carbon fibers released from United States general aviation aircraft in the aftermath of a fire. Of the expected 354 annual general aviation aircraft accidents with fire projected for 1993, approximately 88 could involve carbon fibers. The average annual loss was estimated to be about $250 (1977 dollars) and the likelihood of exceeding $107,000 (1977 dollars) in annual loss in any one year was estimated to be at most one in ten thousand. Author

N80-26392*# Little (Arthur D.), Inc., Cambridge, Mass.

AN ASSESSMENT OF THE RISK ARISING FROM ELECTRICAL EFFECTS ASSOCIATED WITH CARBON FIBERS RELEASED FROM COMMERCIAL AIRCRAFT FIRES

Ashok S. Kalelkar, Joseph Fiksel, Donald Rosenfield, David L. Richardson, and John Hagopian Feb. 1980 144 p
(Contract NAS1-15380)
(NASA-CR-159205; C-81857) Avail: NTIS HC A07/MF A01 CSCL 11D

The risks associated with electrical effects arising from carbon fibers released from commercial aviation aircraft fires were estimated for 1993. The expected annual losses were estimated to be about $470 (1977 dollars) in 1993. The chances of total losses from electrical effects exceeding $100,000 (1977 dollars) in 1993 were established to be about one in ten thousand. Author

N80-26393*# Operations Research, Inc., Silver Spring, Md.

ADVANCED RISK ASSESSMENT OF THE EFFECTS OF GRAPHITE FIBERS ON ELECTRONIC AND ELECTRIC EQUIPMENT

L. Pocinki, Merrill Cornell, and Lawrence Kaplan May 1980 167 p refs
(Contract NAS1-15379)
(NASA-CR-159210) Avail: NTIS HC A08/MF A01 CSCL 11D

An assessment of the risk associated with accidents involving aircraft with carbon fiber composite structural components is examined. The individual fiber segments cause electrical and electronic equipment to fail under certain operating conditions. A Monte Carlo simulation model was used to computer the risk. Aircraft accidents with fire, release of carbon fiber material, entrainment of carbon fibers in a smoke plume transport of fibers downwind, transfer of some fibers/into the the interior of buildings, failures of electrical and electronic equipment, and economic impact of failures are discussed. Risk profiles were prepared for individual airports and the Nation. The vulnerability of electrical transmission equipment to carbon fiber incursion and aircraft accident total costs is investigated. B.D.

N80-26394*# Little (Arthur D.), Inc., Cambridge, Mass.

AS ASSESSMENT OF POWER SYSTEM VULNERABILITY TO RELEASE OF CARBON FIBERS DURING COMMERCIAL AVIATION ACCIDENTS

Gerald R. Larocque Jan. 1980 41 p refs
(Contract NAS1-15380)
(NASA-CR-159208) Avail: NTIS HC A03/MF A01 CSCL 11D

The vulnerability of a power distribution system in Bedford and Lexington, Massachusetts to power outages as a result of exposure to carbon fibers released in a commercial aviation accident in 1993 was examined. Possible crash scenarios at Logan Airport based on current operational data and estimated carbon fiber usage levels were used to predict exposure levels

and occurrence probabilities. The analysis predicts a mean time between carbon fiber induced power outages of 2300 years with an expected annual consequence of 0.7 persons losing power. In comparison to historical outage data for the system, this represents a 0.007% increase in outage rate and 0.07% increase in consequence. Author

N80-26395*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
UNIAXIAL AND BIAXIAL TENSIONING EFFECTS ON THIN MEMBRANE MATERIALS
W. F. Hinson and J. W. Goslee Jun. 1980 25 p refs
(NASA-TM-81812) Avail: NTIS HC A02/MF A01 CSCL 11D

Thin laminated membranes are being considered for various surface applications on future large space structural systems. Some of the thin membranes would be stretched across or between structural members with the requirement that the membrane be maintained within specified limits of smoothness which would be dictated by the particular applications such as antenna reflector requirements. The multiaxial tensile force required to maintain the smoothness in the membrane needs to be determined for use in the structure design. Therefore, several types of thicknesses of thin membrane materials have been subjected to varied levels of uniaxial and biaxial tensile loads. During the biaxial tests, deviations of the material surface smoothness were measured by a noncontacting capacitance probe. Basic materials consisted of composites of vacuum deposited aluminum on Mylar and Kapton ranging in thickness from 0.00025 in (0.000635 cm) to 0.002 in (0.00508 cm). Some of the material was reinforced with Kevlar and Nomex scrim. The uniaxial tests determined the material elongation and tensile forces up to ultimate conditions. Biaxial tests indicated that a relatively smooth material surface could be achieved with tensile force of approximately 1 to 15 Newtons per centimeter, depending upon the material thickness and/or reinforcement. Author

N80-26396*# Rocketdyne, Canoga Park, Calif.
DEVELOPMENT AND DEMONSTRATION OF MANUFACTURING PROCESSES FOR FABRICATING GRAPHITE/LARC-160 POLYIMIDE STRUCTURAL ELEMENTS, PART 4, PARAGRAPH B Quarterly Progress Report, 16 Dec. 1979 - 15 Mar. 1980
15 Mar. 1980 248 p
(Contract NAS1-15371)
(NASA-CR-159303; QPR-7-Pt-4) Avail: NTIS HC A11/MF A01 CSCL 11D

A quality assurance program was developed which included specifications for celion/LARC-160 polyimide materials and quality control of materials and processes. The effects of monomers and/or polymer variables and prepeg variables on the processibility of celion/LARC prepeg were included. Processes for fabricating laminates, honeycomb core panels, and chopped fiber moldings were developed. Specimens and conduct tests were fabricated to qualify the processes for fabrication of demonstration components. R.C.T.

N80-26397*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
THERMAL CYCLING GRAPHITE-POLYIMIDE
Michael W. Hyer and Jane A. Hagaman (Old Dominion Univ.) Apr. 1979 134 p refs
(Grant NsG-1167)
(NASA-CR-163294; VPI-E-79-115) Avail: NTIS HC A07/MF A01 CSCL 11D

The effects of repetitive thermal cycling on the temperature-thermal deformation relation of graphite-polyimide were determined. The bending and axial strains, measured with strain gages, of unsymmetric [0 deg sub 2/90 deg sub 2] and [0 deg sub 4/90 deg sub 4] laminates were used as an indication of thermal deformation. The strains were measured as a function of temperature and two temperature ranges were used, room temperature to 180 C and room temperature to 315 C. Five cycles were run in each temperature range and the cycling was done in quasistatic fasion. The response of a flat [0 deg sub 8] laminate was measured as were the effects of repetitive cycling on the strain gages themselves. A piece-wise linear theory, based on classical lamination theory and using the variation of mechanical and thermal expansion properties with temperature, was compared with the experimental results. The correlation between theoretical predictions and experimental results for the thinner laminate was poor. R.C.T.

N80-26398*# Virginia Polytechnic Inst. and State Univ., Blacksburg
THE STRUCTURAL BEHAVIOR OF A GRAPHITE-POLYIMIDE HONEYCOMB SANDWICH PANEL WITH QUASI-ISOTROPIC FACE SHEETS AND AN ORTHOTROPIC CORE
Michael W. Hyer and Jane A. Hagaman (Old Dominion Univ. Research Foundation) Jun. 1979 124 p refs
(Grant NsG-1167)
(NASA-CR-163297; VPI-E-79-23) Avail: NTIS HC A06/MF A01 CSCL 11D

The results of a series of tests of graphite-polyimide honeycomb sandwich panels are presented. The panels were 1.22 m long, 0.508 m wide, and approximately 13.3 m thick. The face sheets were a T-300/PMR-15 fabric in a quasi-isotropic layup and were 0.279 mm thick. The core was Hexcel HRH 327-3/16 - 4.0 glass reinforced polyimide honeycomb, 12.7 mm thick. Three panels were used in the test: one was cut into smaller pieces for testing as beam, compression, and shear specimens; a second panel was used for plate bending tests; the third panel was used for in-plane stability tests. Presented are the experimental results of four point bending tests, short block compression tests, core transverse shear modulus, three point bending tests, vibration tests, plate bending tests, and panel stability tests. The results of the first three tests are used to predict the results of some of the other tests. The predictions and experimental results are compared, and the agreement is quite good. E.D.K.

N80-26399*# Oregon Graduate Center for Study and Research, Beaverton.
FABRICATION AND SURFACE CHARACTERIZATION OF COMPOSITE REFRACTORY COMPOUNDS SUITABLE FOR THERMIONIC CONVERTERS Annual Report, 1 Aug. 1978 - 31 Jul. 1979
P. R. Davis and L. W. Swanson Dec. 1979 81 p refs
(Contracts NAS7-100; JPL-955156)
(NASA-CR-163040; JPL-9950-356) Avail: NTIS HC A05/MF A01 CSCL 11D

The techniques of fabricating and characterizing the surface properties of electrode materials were investigated. The basic surface properties of these materials were studied with respect to their utilization as thermionic energy converter electrodes. Emphasis was placed on those factors (e.g. cesium disorption kinetic and mechanisms of low work function production) which are of primary concern to thermionic converter performance. R.C.T.

N80-26400*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MASS LOSS OF A TEOS-COATED, REINFORCED CARBON-CARBON COMPOSITE SUBJECTED TO A SIMULTED SHUTTLE ENTRY ENVIRONMENT
C. W. Stroud and Donald R. Rummler Jul. 1980 62 p
(NASA-TM-81799; L-13400) Avail: NTIS HC A04/MF A01 CSCL 11D

Coated, reinforced carbon-carbon (RCC) is used for the leading edges of the space shuttle. The mass loss characteristics of RCC specimens coated with tetraethyl orthosilicate (TEOS) were determine for conditions which simulated the environment expected at the lug attachment area of the leading edge. Mission simulation included simultaneous application of load, temperature, and oxygen partial pressure. Maximum specimen temperature was 900 K (1160 F). Specimens were exposed for up to 80 simulated missions. Stress levels up to 6.8 MPa (980 psi) did not significantly affect the mass loss characteristics of the TEOS-coated RCC material. Mass loss was correlated with the bulk density of the specimens. Author

N80-26401# Manchester Univ. (England). Dept. of Metallurgy.
MEASUREMENT OF THE THERMAL DIFFUSIVITY OF

CARBON/CARBON FIBER COMPOSITES FROM 20-3000 C
Interim Report, 30 Sep. 1977 - 30 Sep. 1979
R. Taylor and R. N. Proctor Nov. 1979 74 p refs
(Grant AF-AFOSR-3449-77; AF Proj. 2308)
(AD-A083570; AFOSR-80-0320TR) Avail: NTIS HC A04/MF A01 CSCL 11/4

Thermal diffusivity measurements from 300-3000 K have been made on the following materials using the laser pulse method: (a) 3-D carbon fiber carbon composites types 'A' and 'B' made using Fiber 'F' material; (b) 1-D carbon fiber composite; (c) the matrix material used in their fabrication. Thermal conductivity has been calculated from these results and a model of composite conductivity presented. GRA

N80-26402# Marquette Univ., Milwaukee, Wis. Dept. of Mechanical Engineering.
PRESSURE AND TEMPERATURE BEHAVIOR OF FRAMEWORK SILICATES AND NITRIDES
L. Cartz and J. D. Jorgensen 1979 8 p refs Presented at 16th Intern. Thermal Conductivity Conf. and 7th Intern. Thermal Expansion Symp., Chicago, 7-9 Nov. 1979 Prepared in cooperation with Argonne Nat. Lab., Ill.
(Contract W-31-109-eng-38)
(CONF-791134-11) Avail: NTIS HC A02/MF A01

The response of silicates and nitrides to changes of pressure or of temperature depends on the flexibility of the bond angles of the crystal structures. Where bond angles can vary between neighboring tetrahedra linked at one corner, relative tilting or rotations occur which modify the three dimensional framework and this dominates the response of the crystal structure to temperature or pressure changes. Direct evidence for this behavior is available from measurements by time-of-flight neutron diffraction with multi-component profile refinement procedures, where atomic position changes have been determined to pressures of approximately 3 x 10 to the 9th power Pa. The importance of the framework structural type was illustrated by studies of the flexible alpha quartz structures of SiO2 and GeO2 which have volume compressibility coefficients K/sub v/ approximately 26 x 10 to the minus 12 power/Pa, the partially flexible structures Si2N2O and Ge2N2O with K approximately 9 x 10 to the minus 12 power/Pa, and the rigid structures alpha and beta Si3N4 with k/sub v/ approximately 3 x 10 to the minus 12 power/Pa. DOE

N80-26403# Dow Corning Corp., Midland, Mich.
DEVELOPMENT OF IMPROVED INSULATION MATERIALS
Final Technical Report, 1 Sep. 1978 - 30 Sep. 1979
J. A. Rabe, S. Spells, G. R. Homan, D. M. Rasch, C. L. Lee, and R. C. Parmele Sep. 1979 168 p refs
(Contract EM-78-C-04-4295)
(ALO-4295-T2) Avail: NTIS HC A08/MF A01

Evaluations of three types of silicone foam, for use as insulation in flat plate solar collectors are presented. The three types of foam were: Type 1A: a two part, room temperature curing foam corss linked through identical with SiOSi identical with linkages; Type 1B: a one part, heat activated foam also crosslinked through identical with SiOSi identical with bonds; and Type 2: a two part, room temperature curing foam cross linked with – NCOS(CH2)3 identical with linkages. A composite, in which a thin layer of type 1A foam protects a secondary layer of less expensive but thermally unstable isocyanurate foam, is also evaluated. DOE

N80-26404# Societe Nationale Industrielle Aerospatiale, Paris (France).
ON THE PRODUCTION OF COMPOSITE MATERIALS [PRODUIRE EN COMPOSITE]
M. Georges Jube 1979 25 p In FRENCH
(SNIAS-792-502-103) Avail: NTIS HC A02/MF A01

The properties, advantages and disadvantages of composite materials are presented. The suppliers of these materials are given, together with the different ways in which they are fabricated and later employed. The problems encountered with these materials are discussed. The specific materials manufactured by various companies are described together with their characteristics. Design features, calculation principles and certification procedures are reviewed together with cost considerations. Aeronautic and other applications in the United States and European countries are presented. Author (ESA)

N80-26405# Royal Aircraft Establishment, Farnborough (England).
EFFECT OF DEGREE OF ABRASION OF CARBON FIBER COMPOSITE SURFACES ON STRENGTHS OF ADHESIVE BONDED JOINTS
M. H. Stone London HMSO Dec. 1979 10 p refs
(RAE-TM-MAT-327; BR71986) Avail: NTIS HC A02/MF A01

Strengths of double lap joints between carbon fiber composite and aluminum alloy varied over a three fold range, and low strengths were correlated with a high proportion of failure in adhesion to the composite. Low strengths were traced to incomplete abrasion by grit blasting of the composite surface before bonding, although the effect appeared to depend on the adhesive used. Low strengths of lightly abraded joints were probably due to PTFE residues from release cloth. Careful control of blasting conditions allied to thorough inspection is necessary to ensure complete abrasion without exposure of carbon fiber. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-26406*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CELL AND METHOD FOR ELECTROLYSIS OF WATER AND ANODE THEREFOR Patent Application
John R. Aylward, inventor (to NASA) (Hamilton Standard, Windsor Locks, Conn.) Filed 20 Jun. 1980 20 p Sponsored by NASA
(NASA-Case-MSC-16394-1; US-Patent-Appl-SN-161255) Avail: NTIS HC A02/MF A01 CSCL 07D

An electrolytic cell for the conversion of water vapor to oxygen and hydrogen is disclosed. The electrolytic converter includes an anode comprising a foraminous conductive metal base member having a coating thereon of 65-85 weight percent iridium oxide and 15-35 weight percent of a high temperature resin binder. Also included are a matrix member and a cathode, with the matrix member containing an electrolyte and the cathode being substantially inert to the electrolyte. The foraminous metal member is most desirably expanded tantalum mesh, and the cell desirably includes reservoir elements of porous sintered metal in contact with the anode to receive and discharge electrolyte to the matrix member as required. Upon entry of a water vapor-containing airstream into contact with the outer surface of the anode and thence into contact with iridium oxide coating, the water vapor is electrolytically converted to hydrogen ions and oxygen with the hydrogen ions migrating through the matrix to the cathode and the oxygen gas produced at the anode to enrich the air stream passing by the anode. NASA

N80-26407*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
PREPARATION OF PERFLUORINATED 1,2,4-OXADIAZOLES Patent Application
Reinhold H. Kratzer (Ultrasystems, Inc., Irvine, Calif.), Kaximiera J. L. Paciorek (Ultrasystems, Inc., Irvine, Calif.), Thomas I. Ito (Ultrasystems, Inc., Irvine, Calif.), and Robert W. Rosser, inventors (to NASA) Filed 27 Jun. 1980 9 p
(NASA-Case-ARC-11267-2; US-Patent-Appl-SN-163838) Avail: NTIS HC A02/MF A01 CSCL 07D

A method of preparing fluorinated alkyl or alkylether 1,2,4-oxadiazoles is disclosed. The oxadiazoles are synthesized by cyclizing the corresponding alkyl or alkylether imidoylamidoximes in vacuo or in an inert atmosphere at a temperature within the range of 40 to 100 C for a period of 8 to 144 hours in the presence of an acid compound which can accept ammonia to form a salt. The imidoylamidoximes usable in this process

may be either polymeric or nonpolymeric. As a result of the low cyclization temperatures, the quality and quantity of the 1,2,4-oxadiazole polymers are better than other disclosed processes. NASA

N80-26408*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SUBMILLIMETER, MILLIMETER, AND MICROWAVE SPECTRAL LINE CATALOGUE
R. L. Poynter and H. M. Pickett 1 Jun. 1980 141 p refs
(NASA-CR-163284; JPL-Pub-80-23) Avail: NTIS HC A07/MF A01 CSCL 07D

A computer accessible catalogue of submillimeter, millimeter, and microwave spectral lines in the frequency range between 0 and 3000 GHz (such as; wavelengths longer than 100 m) is discussed. The catalogue was used as a planning guide and as an aid in the identification and analysis of observed spectral lines. The information listed for each spectral line includes the frequency and its estimated error, the intensity, lower state energy, and quantum number assignment. The catalogue was constructed by using theoretical least squares fits of published spectral lines to accepted molecular models. The associated predictions and their estimated errors are based upon the resultant fitted parameters and their covariances. B.D.

N80-26409*# Institute of Gas Technology, Chicago, Ill.
STUDIES OF THERMOCHEMICAL WATER-SPLITTING CYCLES Final Report
R. J. Remick and S. E. Foh May 1980 48 p refs
(Contracts NAS7-100; JPL-955494)
(NASA-CR-163029; JPL-9950-371) Avail: NTIS HC A03/MF A01 CSCL 07D

Higher temperatures and more isothermal heat profiles of solar heat sources are developed. The metal oxide metal sulfate class of cycles were suited for solar heat sources. Electrochemical oxidation of SO2 and thermochemical reactions are presented. Electrolytic oxidation of sulfur dioxide in dilute sulfuric acid solutions were appropriate for metal oxide metal sulfate cycles. The cell voltage at workable current densities required for the oxidation of SO2 was critical to the efficient operation of any metal oxide metal sulfate cycle. A sulfur dioxide depolarized electrolysis cell for the splitting of water via optimization of the anode reaction is discussed. Sulfuric acid concentrations of 30 to 35 weight percent are preferred. Platinized platinum or smooth platinum gave the best anode kinetics at a given potential of the five materials examined. B.D.

N80-26410*# Illinois Univ. at Urbana-Champaign, Urbana.
EFFECT OF A ZERO g ENVIRONMENT ON FLAMMABILITY LIMITS AS DETERMINED USING A STANDARD FLAMMABILITY TUBE APPARATUS Final Report
Roger A. Strehlow and David L. Reuss Jun. 1980 30 p refs
Document includes a Microfiche supplement
(Grant NsG-3043)
(NASA-CR-3259) Avail: NTIS HC A03/MF A01 CSCL 21B

Flammability limits in a zero gravity environment were defined. Key aspects of a possible spacelab experiment were investigated analytically, experimentally on the bench, and in drop tower facilities. A conceptual design for a spacelab experiment was developed. R.C.T.

N80-26411# Arizona Univ., Tucson.
OPERATION OF VAN DE GRAAFF ACCELERATORS FOR BASIC EXPERIMENTS IN ATOMIC SPECTROSCOPY Final Report, 1971 - 1979
Stanley Bashkin 11 Apr. 1980 15 p refs
(Contract N00014-75-C-0499)
(AD-A083623; Rept-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

This contract resulted in the publication of approximately 12 research papers and books per year, primarily in the field of beam-foil spectroscopy. Eight students received the degree of Ph.D., and two the degree of M.S. during the reporting period. One Ph.D. student is currently completing his work. A list of publications and personnel is included. GRA

N80-26412# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Metallics and Surface Interactions Branch.
DATA TREATMENT IN ELECTRON AND ION SPECTROSCOPY Interim Report, Jul. 1977 - Jul. 1979
William L. Baun Dec. 1979 20 p refs Submitted for publication
(AF Proj. 2419)
(AD-A083201; AFML-TR-79-4211) Avail: NTIS HC A02/MF A01 CSCL 07/4

In order to fully utilize newly developed electron and ion surface spectroscopies, the data from these methods must be treated carefully to assure quality and clarity both during and after the experiment. Signal conditioning during the experiment puts the data into proper form for recording and may include steps for amplifying, digitizing, discriminating, modulating, gating, transforming and filtering. In Auger Electron Spectroscopy (AES) where modulation and synchronous detection methods are used, special tailored waveform modulation may be necessary to minimize elemental profile artifacts. Dynamic background subtraction, digital filtering and Fourier transforms improve the signal to noise ratio and facilitate further data processing. If possible, an entire spectrum should be digitally stored at each plotted point on the elemental depth profile. Such spectral storage allows retrieval and examination of the spectrum for peak shape changes or appearance of peaks which were not expected to occur. A point which must be considered is that in bulk spectroscopies we may accumulate signal for whatever period is necessary to obtain desired counting statistics while in surface spectroscopies using an ion beam (such as ISS and SIMS), the eroding surface is ever changing and only a finite time is available for counting at a given depth. GRA

N80-26413# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 7: CYLINDRICAL AND SPHERICAL PREMIXED FLAMES Interim Technical Report
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 32 p refs
(Grant DAAG29-79-C-0121)
(AD-A083546; TR-109-Ch-7; ARO-15882.13-M) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report is Chapter 7 of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. Cylindrical and spherical premixed flames are discussed, the latter with a view to application to the burning monopropellant drop. Cylindrical flames have a planar character, while spherical flames exhibit ignition and extinction. GRA

N80-26414# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 9: BURNER FLAMES
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 36 p refs
(Grant DAAG29-79-C-0121)
(AD-A083547; TR-111-Ch-9; ARO-15882.14-M) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report is Chapter 9 of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. The three parts of a burner flame (namely base, cone and tip) are examined using both the slowly varying and near-equidiffusional theories of Chapter 8. GRA

N80-26415# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 11: STABILITY
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 51 p refs
(Grant DAAG29-79-C-0121)
(AD-A083548; TR-113-Ch-11; ARO-15882.15-M) Avail: NTIS HC A04/MF A01 CSCL 21/2

This report is Chapter 11 of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. The investigation is narrowed to the stability of freely propagating premixed flames, the only area that has yielded to mathematical analysis so far. Special emphasis is placed on the cellular flames that are found experimentally to be the result of instability. GRA

N80-26416# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.

MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 12: IGNITION AND EXPLOSION Interim Report

J. D. Buckmaster and G. C. S. Ludford Mar. 1980 52 p refs (Contract DAAG29-79-C-0121)
(AD-A083549; TR-114-Ch-12; ARO-15882.16-M) Avail: NTIS HC A04/MF A01 CSCL 21/2

This report is Chapter 12 of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. The induction, explosion, transition, propagation and relaxation phases are described for a slab of reactant whose faces are kept at a constant temperature. Under ignition, the application of a heat flux to a half space is considered. Finally, the explosion of initially separated reactants after they have mixed is shown to be very similar to the explosion of premixed reactants. GRA

N80-26417# Texas A&M Univ., College Station. Dept. of Chemical Engineering.

KINETIC ANALYSIS OF COMPLEX REACTION SYSTEMS-METHANOL CONVERSION TO LOW MOLECULAR WEIGHT OLEFINS

Rayford G. Anthony and Balaji Bondili Singh 1979 19 p refs Presented at the 72nd AICHE Meeting, San Francisco, 25 Nov. 1979
(Contract EW-78-S-02-4717)
(CONF-791108-17) Avail: NTIS HC A02/MF A01

An analysis of the selectivity data when converting methanol to low molecular weight hydrocarbons suggest that methane, propylene, and propane are formed by the primary reaction of methanol decomposition. Ethane, carbon monoxide, and dimethyl ether are formed by primary reactions and participate in secondary reactions. Carbon dioxide and ethylene are produced by secondary reactions. DOE

N80-26418# Brookhaven National Lab., Upton, N. Y.

UPTAKE RATES FOR HYDROGEN BY Nb AND Ta: EFFECT OF THIN METALLIC OVERLAYERS

M. A. Pick, Myron Strongin, and M. G. Greene 1980 12 p refs Presented at the Intern. Symp. on the Properties and Appl. of Metal Hybrides, Colorado Springs, Colo., 7 Apr. 1980
(Contract EY-76-C-02-0016)
(BNL-27208; CONF-800402-7) Avail: NTIS HC A02/MF A01

The hydrogen uptake rates of clean Nb and Ta foils were measured as a function of temperature and pressure. The sticking coefficient (number of hydrogen atoms entering the bulk divided by the number of hydrogen atoms hitting the surface) of hydrogen on clean Nb and Ta, at approximately .000022 Torr hydrogen and room temperature, was found to be surprisingly low, approximately .005 and approximately .05. The uptake rates were enhanced or decreased by the surface deposition of a thin layer of Pd, Pt, or Ni. For Pb a layer less than one monolayer thick did not change or even inhibit the hydrogen uptake, whereas a layer over one monolayer thick enhanced the sticking coefficient to a value of 1. The change at one monolayer was related to a phase transition of the Pd surface layer at that coverage. Both Pt and Ni did not exhibit this effect but did influence the uptake rate by an amount which depended on their thickness. Thick overlayers inhibit uptake due to a limited permeation rate through the layer. DOE

N80-26419# California Univ., Livermore. Lawrence Livermore Lab.

MODELING OF LAMINAR FLAMES IN MIXTURES OF VAPORIZED LIQUEFIED NATURAL GAS (LNG) AND AIR

Charles K. Westbrook 5 Feb. 1980 12 p refs
(Contract W-7405-ENG-48)
(UCID-18540) Avail: NTIS HC A02/MF A01

Numerical models dealing with the liquefied natural gas vapor cloud generation and dispersion were developed. Chemical kinetics submodels were required for these codes to describe the fuel air burning that might occur in a large LNG spill. The development of these chemical kinetics submodels is described. DOE

N80-26420# Sandia Labs., Albuquerque, N. Mex. Combustion Research Div.

VELOCITY AND TEMPERATURE MEASUREMENTS IN TURBULENT DIFFUSION FLAMES

G. D. Rambach, R. W. Dibble, and R. E. Hollenbach Feb. 1980 56 p refs Presented at the Fall Combust. Meeting, Western States Sect., Berkeley, Calif., 15-16 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-8775; CONF-791048-6; Paper-79-51) Avail: NTIS HC A04/MF A01

Nonintrusive, time and space resolved measurements of velocity and temperature were performed in turbulent diffusion flames. The velocity measurements were made with a laser Doppler velocimeter on a confined turbulent hydrogen diffusion flame in coflowing air. Mean velocity, velocity standard deviation and turbulence intensity profiles were produced and compared with high speed shadowgraph movies and visual measurements of the flame boundaries. Single point velocity probability density functions were also produced for all spatial measurement points. Temperature measurements were made using Rayleigh scattering on an unconfined turbulent diffusion flame. The fuel and its products had approximately the same Rayleigh scattering cross section as air so that temperature could be inferred directly from the scattering intensity using the state equation for a perfect gas. The temperature measurements also included the probability density functions at several locations. DOE

N80-26421# Rockwell International Corp., Richland, Wash. Handford Operations.

HIGH PRESSURE LIQUID CHROMATOGRAPHY WITH ELEMENT-SPECIFIC DETECTION

D. E. Nelson and J. G. Metcalf Jun. 1979 14 p refs Presented at 34th Northwest Regional Meeting of the Am. Chem. Soc., Richland, Wash., 13 Jun. 1979
(Contract EY-77-C-06-1030)
(RHO-SA-115; CONF-790666-7) Avail: NTIS HC A02/MF A01

Element specific detection for high pressure liquid chromatography is discussed in terms of its several advantages over nospecific detection. These advantages include: simpler chromatograms (less peak overlap); faster analysis costly solvents can be used. Three applications (chemistry speciation, rare earth separations, and ethylenediamine triacedic acid/N-(2-hydroxyethyl) ethylenediamine triacedic acid determinations are discussed. DOE

N80-26422# National Physical Lab., Teddington (England). Div. of Chemical Standards.

THE ENTHALPY OF FUSION OF INDIUM: CERTIFICATION OF A SAMPLE FOR USE AS A CRM

R. J. L. Andon, J. E. Connett, and J. F. Martin Jul. 1979 14 p refs
(NPL-Chem-101) Avail: NTIS HC A02/MF A01

The enthalpies of fusion of three samples of indium were measured by adiabatic calorimetry. One sample was certified for use as a reference material for thermal analysis. The equipment and the experimental technique are described. The results of the measurements are presented and discussed in the light of published work. Author (ESA)

N80-26423# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computer Science.

NUMERICAL SOLUTION OF STEADY DIFFUSION-MIGRATION EQUATIONS REPRESENTING THE MASS CONCENTRATION OF DISSOLVED SPECIES IN CRACKS

D. H. Ferriss and G. F. Miller Nov. 1979 27 p refs
(NPL-NAC-22/79) Avail: NTIS HC A03/MF A01

Numerical techniques are employed to determine solutions to systems of nonlinear ordinary differential equations arising in the one dimensional analysis of steady diffusion and migration of dissolved species in metal cracks. In one situation where the migration effect is ignored it is shown that, to a good approximation, the problem can be reduced to the solution of an algebraic quartic equation. The validity of this approximation is investigated. In general, the problems in ordinary differential equations are converted to nonlinear integral equations to which a variant of the Newton-Raphson iterative techniques is applied. Author (ESA)

N80-26424# Materials Quality Assurance Directorate, London (England). Analytical Development Branch.

THE DETERMINATION OF SILICON BY ATOMIC ABSORPTION SPECTROMETRY
B. T. N. Newland HMSO Nov. 1977 19 p refs
(MOAD-TP-685; BR60889) Avail: NTIS HC A02/MF A01

The determination of silicon by atomic absorption spectrometry was investigated and applied to the analysis of a machine washing powder and silicone alkyd paint binders in aqueous and organic solvents respectively. Interferences by other ions in aqueous solutions are overcome by the addition of sodium, while in the organic solvent, interferences are minimal. Coefficients of variation are of the order 0.6% in aqueous solution and 1.0% in organic solvent. Author (ESA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-26425 Wisconsin Univ. - Madison.
MODE 3 DUCTILE FRACTURE OF 2024-T351 ALUMINUM Ph.D. Thesis
William Robert Garver 1979 183 p
Avail: Univ. Microfilms Order No. 8008815

The fracture of torsionally-loaded circumferentially notched aluminum cylinders was studied. Stress-field solutions based on continuum theory and models of fracture for a microscopically heterogeneous material are discussed. Fracture initiation is analyzed in terms of Mode III stress intensity factor, the J-integral, and the near notch tip shear strain. The integral expression for J in cylindrical coordinates is included along with an expression to determine J for deeply notched geometries from the torsional load displacement record. A finite difference formulation for power-law-hardening elastic-plastic material is used to obtain the stress field solution for a notched cylinder loaded in torsion. Better agreement with experimental results is obtained using a fracture initiation criterion based on achieving a critical strain throughout a finite fracture process zone than using criteria based on the stress intensity factor or the J-integral. The transition from stable to unstable crack growth is analyzed using the tearing modulus concept. Calculations are consistent with experiment. However, evidence is presented indicating that an undetermined amount of Mode I loading occurs at a crack tip nominally loaded in Mode III, preventing more exact analysis of fracture instability. Dissert. Abstr.

N80-26426*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED PFB OPERATIONS: 400-HOUR TURBINE TEST RESULTS
R. J. Rollbuhler, S. M. Benford, and G. R. Zellars 1980 23 p refs Presented at 6th Intern. Conf. on Fluidized Bed Combust., Atlanta, 9-11 Apr. 1980; sponsored by DOE, Elec. Power Res. Inst., EPA and TVA
(NASA-TM-81511; E-260) Avail: NTIS HC A02/MF A01 CSCL 11F

A pressurized fluidized bed (PFB) coal-burning reactor was used to provide hot effluent gases for operation of a small gas turbine. Preliminary tests determined the optimum operating conditions that would result in minimum bed particle carryover in the combustion gases. Solids were removed from the gases before they could be transported into the test turbine by use of a modified two stage cyclone separator. Design changes and refined operation procedures resulted in a significant decrease in particle carryover, from 2800 to 93 ppm (1.5 to 0.05 grains/std cu ft), with minimal drop in gas temperature and pressure. The achievement of stable burn conditions and low solids loadings made possible a 400 hr test of small superalloy rotor, 15 cm (6 in.) in diameter, operating in the effluent. Blades removed and examined metallographically after 200 hr exhibited accelerated oxidation over most of the blade surface, with subsurface alumina penetration to 20 micron m. After 400 hours, average erosion loss was about 25 micron m (1 mil). Sulfide particles, indicating hot corrosion, were present in depletion zones, and their presence corresponded in general to the areas of adherent solids deposit. Sulfidation appears to be a materials problem equal in importance to erosion. A.R.H.

N80-26427*# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
HOT CORROSION OF Co-Cr, Co-Cr-Al, AND Ni-Cr ALLOYS IN THE TEMPERATURE RANGE OF 700-750 DEG C Semiannual Report, 1 Sep. 1979 - 29 Feb. 1980
K. T. Chiang and G. H. Meier Jun. 1980 29 p
(Grant NsG-3214)
(NASA-CR-159689; SAR-3) Avail: NTIS HC A03/MF A01 CSCL 11F

The effect of SO3 pressure in the gas phase on the Na2SO4 induced hot corrosion of Co-Cr, Ni-Cr, and Co-Cr-Al alloys was studied in the temperature range 700 to 750 C. The degradation of the Co-Cr and Ni-Cr alloys was found to be associated with the formation of liquid mixed sulfates (CoSO4-Na2SO4 or NiSO4-Na2SO4) which provided a selective dissolution of the Co or Ni and a subsequent sulfidation oxidation mode of attack which prevented the maintenance of a protective Cr2O3 film. A clear mechanism was not developed for the degradation of Co-Cr-Al alloys. A pitting corrosion morphology was induced by a number of different mechanisms. B.D.

N80-26428# United Technologies Research Center, East Hartford, Conn.
COATINGS FOR DIRECTIONALLY SOLIDIFIED GAMMA PRIME-GAMMA PLUS ALPHA EUTECTICS Final Report, Aug. 1978 - Nov. 1979
John G. Smeggil Oct. 1979 36 p refs
(Contract N62269-78-C-0311)
(AD-A081934; UTRC/R79-914424-4) Avail: NTIS HC A03/MF A01 CSCL 11/3

Coating compositions were developed to protect the directionally solidified gamma/gamma prime-alpha alloy (Ni-31w/oMo-6.2w/oAl) during cyclic oxidation and sulfidation in burner rig tests. The coating composition Ni-13.8w/oCo-15.8w/oCr-8.2w/oAl-16.9w/oPt-0.1w/oY was specifically identified in this study. For the family of alloys represented by gamma prime-alpha, the addition of 17 percent platinum to the NiCoCrAlY composition was insufficient to prevent cracking of the coating. Coatings containing 37 w/o platinum did not crack in the 2100 F cyclic oxidation tests. Chromium used as an intervening layer between gamma prime-alpha and the overlay coating reacted with the substrate to form brittle phases which cracked during thermal cycling. The substitution of nickel for chromium as an intervening layer resulted in void formation (Kirkendall porosity) leading to eventual coating delamination. GRA

N80-26429# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
THIN ANODIC OXIDE FILMS ON ALUMINUM ALLOYS AND THEIR ROLE IN THE DURABILITY OF ADHESIVE BONDS Final Report, Jan. - Feb. 1979
Neil T. McDevitt and James S. Solomon Feb. 1980 29 p refs
(AF Proj. 2419)
(AD-A083202; AFML-TR-79-4216) Avail: NTIS HC A03/MF A01 CSCL 11/6

The structure and chemical composition of anodic oxide films on aluminum alloys is discussed with reference to pure aluminum. The potential effects of these inhomogeneities are also discussed with reference to the durability of adhesively bonded structures. GRA

N80-26430# SRI International Corp., Menlo Park, Calif.
FURTHER DEVELOPMENT OF A COMPUTATIONAL SHEAR BAND MODEL Final Report, May 1977 - Sep. 1978
D. C. Erlich, D. R. Curran, and L. Seaman Mar. 1980 85 p refs
(Contract DAAG46-77-C-0043)
(AD-A083574; AMMRC-TR-80-3) Avail: NTIS HC A05/MF A01 CSCL 11/6

Experimental and analytical work was performed to improve the computational model for adiabatic shear band nucleation and growth (SNAG). A series of contained fragmenting cylinder experiments were performed with 4340 steel treated to hardness of R sub c 40, R sub c 52, and R sub c 21. The resulting damage ranged from homogeneous plastic deformation to extensive shear banding and resulting fragmentation. The results showed strong positive correlation between shear banding damage

and material hardness for identical loading conditions. A simplified method of damage quantification was used to obtain shear band density, size and orientation distributions for all of the R sub c 40 experiments. Preliminary computer simulations were performed to determine plastic shear strain rate histories in the direction of the predominant shear banding orientation mode, and the computations were compared with experimental data to yield first estimates for the values of the nucleation and growth parameters. A shear band nucleation criterion based on measurable material properties was proposed and tested against the experimental data; the criterion was seen to be promising although not yet conclusive. Several experimental techniques for characterizing the shear banding resistance of materials were evaluated and compared. The contained fragmenting cylinder experiment was concluded to be the best single technique, although the dynamic punch test has special value for armor penetration applications. GRA

N80-26431# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.

APPLICATION OF RAPIDLY SOLIDIFIED ALLOYS

C. M. Adam, R. G. Bourdeau, J. W. Broch, and A. R. Cox Jun. 1979 25 p

(Contract F33615-76-C-5136)

(AD-A083496; PWA-FR-12127) Avail: NTIS HC A02/MF A01 CSCL 11/6

This program is being conducted for the purpose of applying the principle of rapid solidification to aluminum and iron alloy powder and subsequent development of stronger alloy compositions for fan blade application (Al alloys) and higher speed bearing materials (Fe alloys). Centrifugal atomization and forced convective cooling are being used to produce the fast cooled powder. During this report period, adaptation of the RSR process to aluminum and iron systems was continued. The evalustion of the first aluminum alloy matrix was partially completed, and a second matrix was selected. Hardness testing and microstructural evaluation of Fe alloys was performed. GRA

N80-26432# Naval Research Lab., Washington, D. C. Ocean Technology Div.

CASE STUDIES OF FATIGUE CRACK GROWTH USING AN IMPROVED MICROLIGAMENT INSTABILITY MODEL Interim Report

J. M. Krafft 30 Jan. 1980 71 p refs

(RR0230345; WR0220101)

(AD-A083394; AD-E000392; NRL-MR-4161) Avail: NTIS HC A04/MF A01 CSCL 11/6

The tensile ligament instability model TLIM has been refined and modified. A large set of new data cases is analyzed using the improved algorithm, most of these with high fidelity. In microstructurally varied titanium alloys, the process zone size is associated with the effective grain size; in structural and alloy steels it decreases with increasing yield strength, presumably here too related to grain refinement. The other fitting parameters, of environmental surface attack, show an internal consistency among the various specimen materials and environments. The modified model is thought to provide an advantageous means of comparing crack propagation data, and, in selected classes of materials, a suitable basis for predicting fatigue propagation life. GRA

N80-26433*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THREE DIMENSIONAL FINITE-ELEMENT ELASTIC ANALYSIS OF A THERMALLY CYCLED DOUBLE-EDGE WEDGE GEOMETRY SPECIMEN Final Report, 1 Jun. 1977 - 1 Jan. 1979

Sandra K. Drake, Richard J. Hill, Peter T. Bizon, Jeffrey L. Kladden, and Bruce P. Guilliams Mar. 1980 49 p refs Prepared in cooperation with AF Wright Aeronautical Labs., Wright-Patterson AFB, Ohio

(AF Proj. 3066)

(NASA-TM-80980; AD-A083245; AFWAL-TR-80-2013) Avail: NTIS HC A03/MF A01 CSCL 11/6

An elastic stress analysis was performed on a wedge specimen (prismatic bar with double-edge wedge cross-section) subjected to thermal cycles in fluidized beds. Five alloys (IN 100, Mar-M 200, Mar-M 302, NASA TAZ-8A, and Rene 80) subjected to the same thermal cycling condition were analyzed. This condition was alternate 3 minute immersions in fluidized beds maintained at 316 C and 1088 C (600 and 1990 F). The analyses were performed as a joint effort of two laboratories using different models and computer programs (NASTRAN and ISO3DQ). Stress, strain, and temperature results are presented. GRA

N80-26434# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.

FUNDAMENTAL STUDIES OF HIGH-TEMPERATURE CORROSION REACTIONS Annual Progress Report

Robert A. Rapp, Suresh Verma, B. S. Lee, and G. M. Raynaud Feb. 1980 83 p refs

(Contract DE-AC02-79ER-10404; DE-AC02-79ER-02671)

(DOE/ER/10404-1; APR-5) Avail: NTIS HC A05/MF A01

Metal oxidation reactions and the mechanism of the sulfidation of molybdenum by sulfur gases were studied. Equipment including a SEM microscope, heater, and power supply which were used is described. DOE

N80-26435# Battelle Columbus Labs., Ohio.

STRESS CORROSION CRACKING OF ZIRCONIUM IN NITRIC ACID

J. A. Beavers, J. C. Griess (Oak Ridge Natl. Lab., Tenn.), and W. K. Boyd (Battelle Houston Operations, Tex.) 1980 21 p refs Presented at Natl. Assoc. of Corrosion Engrs. Meeting, Chicago, 3-7 Mar. 1980

(Contract W-7405-eng-26)

(CONF-800305-6) Avail: NTIS HC A02/MF A01

The susceptibility of zirconium and its common alloys to stress corrosion cracking (SCC) in nitric acid was investigated by slow strain rate and constant deflection techniques. Cracking occurred at 25 C over a wide range of acid concentrations and electrochemical potentials. The crack velocity increased slightly with increasing temperature. The failure mode was transgranular and the morphology was similar to SCC failures of zironium alloys in other environments. The fracture was very orientation dependent suggesting that it occurs on a single crystallographic plane in the material. The results are not consistent with a hydrogen mechanism for cracking. DOE

N80-26436# General Astrometals Corp., Yonkers, N.Y.

ASSESSMENT OF MARTENSITIC STEELS AS STRUCTURAL MATERIALS IN MAGNETIC FUSION DEVICES

J. M. Rawls, W. Y. K. Chen, E. T. Cheng, J. A. Dalessandro, P. H. Miller, S. N. Rosenwasser, and L. D. Thompson Jan. 1980 59 p refs

(Contract DE-AT03-76ET-51011)

(GA-A-15749) Avail: NTIS HC A04/MF A01

The results of preliminary experiments are presented and analyzed to assess the feasibility of incorporating ferromagnetic martensitic steels in fusion reactor designs and to evaluate the possible advantages of this class of material with respect first wall/blanket lifetime. The general class of alloys under consideration are ferritic steels containing from about 9 to 13 percent Cr with some small additions of various strengthening elements such as Mo. These steels are conventionally used in the normalized and tempered condition for high temperature applications and can compete favorably with austenitic alloys up to about 600 C. The material and magnetic properties are discussed as well as expected lifetimes for tritium breeding blanket modules. The problem of magnetic perturbations is addressed. Safety and environmental factors are considered. DOE

N80-26437# California Univ., Livermore. Lawrence Livermore Lab.

HYDROGEN ABSORPTION BY YNi5, LaPt5, AND ThNi5 INTERMETALLICS

John F. Lakner and Tako Takeshita 21 Feb. 1980 7 p refs (Contract W-7405-eng-48)

(UCID-18558) Avail: NTIS HC A02/MF A01

The absorption of H by YNi5, LaPt5 and ThNi5 at pressures above those reported in the literature were studied. These alloys were reported to absorb no significant H2 at low pressures. DOE

N80-26438# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.

STUDY OF LOCAL ATOMIC AND ELECTRONIC STRUCTURE IN GLASSY METALLIC ALLOYS Progress Report, 1 Mar. - 1 Dec. 1979
R. P. Messmer and J. Wong 1979 29 p refs
(Contract DE-AC02-79ER-10382)
(DOE/ER-10382/1) Avail: NTIS HC A03/MF A01

Atomic arrangements in metallic glasses as characterized by X-ray diffraction are reviewed. The EXAFS experiment to study the local structure and dynamics of ferromagnetic metals in a series of Fe(40)Ni(40)P(20-x)B(x) glasses as a function of phosphorus content and annealing temperature are reported. Theoretical results in a study of cluster models of amorphous metal alloys. A.R.H.

N80-26439# Ames Lab., Iowa. Dept. of Materials Science and Engineering.
ELECTRO- AND THERMOTRANSPORT OF CARBON IN IRON-NICKEL ALLOYS Ph.D. Thesis
Ignatius Celestine Izuchukwu Okafor Mar. 1980 104 p refs
(Contract W-7405-eng-82)
(IS-T-987) Avail: NTIS HC A06/MF A01

Results of studies on the electrotransport, thermotransport and chemical diffusion of carbon in gamma phase iron - 32.5 wt % nickel alloys are described. The transport parameters Z, Q and D were measured as a function of temperature and carbon concentration and values for the activation energies for diffusion and electrotransport were obtained. The solubility limit of carbon in gamma Fe-32.5 wt % Ni for the temperature range 850 C to 1200 C and the electrical resistivity versus temperature for carbon concentrations of 0.0, 0.1, 0.2, 0.5 and 0.86 wt % C between 25 C and 1350 C were determined. An anomalously large mass transport effect observed in two phase alloy during thermotransport experiments was investigated for the Fe-Ni-C system. DOE

N80-26440# Ohio State Univ., Columbus. Fontana Corrosion Center.
CORROSION, STRESS CORROSION CRACKING, AND ELECTROCHEMISTRY OF THE IRON AND NICKEL BASE ALLOYS IN CAUSTIC ENVIRONMENTS Final Report
R. Koehler, F. H. Beck, A. K. Agrawal, B. Soendjasmono, and R. W. Staehle Feb. 1980 56 p refs
(Contract DE-AS02-76ER-02421)
(DOE/ER-02421/6) Avail: NTIS HC A04/MF A01

The electrochemical behavior of high purity (99.95% to 99.99%) iron in 0.6M NaCl and 1.0M Na2SO4 containing H2S (50 ppM to 34,000 ppM) was studied using cyclic voltammetry, chronoamperometry, and slow scan rate polarization. Results indicate that iron does undergo passivation in sulfate solutions containing H2S, iron dissolution depends on the presence of the concentration of H2S and solution pH. An equation is given that describes the anodic Tafel current densities. The slow strain rate test was used to evaluate the effect of electrode potential on the susceptibility of 2-1/4Cr, Mo steel to stress corrosion cracking in boiling 50% NaOH solution. Susceptibility decreased and general corrosion increased with increasing potentials. Failures contained a combination of ductile and brittle fracture. Time-to-failure was longest for controlled potentials of -700 and -600 mV (Hg/HgO reference) in the -1100 to -400 mV range in this study. DOE

N80-26441# Little (Arthur D.), Inc., Cambridge, Mass.
SURVEY OF POTENTIAL PROCESSES FOR THE MANUFACTURING OF ALUMINUM
Dec. 1979 84 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-79-4) Avail: NTIS HC A05/MF A01

Alternative processes to the Hall-Heroult cell for the production of primary aluminum direct carbothermic reduction of alumina are considered: reduction of bauxite to an aluminum silicon alloy; the subchloride process; the disproportionation of aluminum sulphide; the production through a nitride intermediate; and electrolysis of aluminum chloride aluminum sulphide and aluminum nitride; and plating from nonaqueous solvents. Energy consumption requirements for these techniques are compared with current Hall-Heroult technology and with projected improved technology - particularly titanium diboride cathodes and permanent anodes. The major conclusion is that the only alternative technology at present is the Alcoa chloride electrolysis process but that sulphide and nitride electrolytic processes offer potential advantages in the future. With the exception of thermal reduction to an aluminum - silicon alloy, none of the carbothermic processes is competitive because they require electric furnaces. Significant improvements in energy consumption could be achieved with titanium diboride cathodes in the Hall-Heroult cell. DOE

N80-26442# Sandia Labs., Livermore, Calif. Material Development Div. 1.
PLATING ON SOME DIFFICULT-TO-PLATE METALS AND ALLOYS
J. W. Dini and H. R. Johnson Feb. 1980 25 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8069) Avail: NTIS HC A02/MF A01

Electrodeposition of coatings on metals such as beryllium, beryllium-copper, Kovar, lead, magnesium, thorium, titanium, tungsten, uranium, zirconium, and their alloys can be problematic. This is due in most cases to a natural oxide surface film that readily reforms after being removed. The procedure recommended for plating on these metals to rely on replacing the oxide film with a displacement coating, or etching to allow mechanical keying between the substrate and plated deposit. The effectiveness of the procedures is demonstrated by interface bond strength found in ring shear and conical head tensile tests. DOE

N80-26443# National Physical Lab., Teddington (England). Div. of Materials Applications.
A MODEL OF CRACK ELECTROCHEMISTRY FOR STEELS IN THE ACTIVE STATE
A. Turnbull and J. G. N. Thomas Oct. 1979 50 p refs
(NPL-DMA(A)-11) Avail: NTIS HC A03/MF A01

A model of the electrochemical and mass transport processes within a static crack was developed for steels in the active state in order to improve the understanding of the electrochemical processes at the crack tip. The main reactions considered were dissolution and hydrolysis of ferrous ions and the cathodic reduction of hydrogen ions and water. The dissolution of alloying elements in the steel (e.g., chromium) and subsequent hydrolysis of the ions was considered and the effect of the buffering action of sea water was examined. Mass conservation equations were constructed for each of the species in the crack and solved using numerical methods. The pH within the crack was evaluated as a function of potential, bulk pH, crack geometry and other parameters and compared to the available experimental data. Author (ESA)

N80-26444# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
HEAT TREATMENT OF LIGHT AERONAUTIC ALLOYS: DEVELOPMENTS IN RESIDUAL STRESS STUDIES [LE TRAITEMENT THERMIQUE DES ALLIAGES LEGERS AERONAUTIQUES. DEVELOPPEMENT DE L'ASPECT. CONTRAINTES RESIDUELLES]
Jacques Odorico 23 Jun. 1979 9 p In FRENCH Presented at Assoc. Tech. de Traitement Thermique Conf., Tarbes, France, 3 Jun. 1978
(SNIAS-792-551-101) Avail: NTIS HC A02/MF A01

The specific case of alloy 7075 in the T73 state was studied. The effect of quenching water temperature on its mechanical characteristics at 20/25 C was investigated. Plastic deformation taking place between quenching and tempering was studied; for certain simply shaped parts, this effect can considerably reduce stress. For more complex parts a deliberately introduced deformation between quenching and tempering may reduce stresses as may a modification in cooling rates. Author (ESA)

N80-26445# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
USE OF THE FISSAD TEST BAR FOR STUDIES, QUALIFICATIONS CONTROL OF AERONAUTICAL CONSTRUCTION MATERIALS [UTILISATION DE L'EPROUVETTE FISSAD DANS LES ETUDES, LES QUALIFICATIONS ET LES CONTROLES DE PRODUITS DESTINES AUX CONSTRUCTIONS AERONAUTIQUES]
Jacques Odorico and Etienne Budillon 6 Apr. 1979 9 p In FRENCH Presented at Meeting Italien sur la Fissuration, Milan, 31 May 1979

(SNIAS-792-551-103) Avail: NTIS HC A02/MF A01

The heat treatments applied to 40 CDV 12 steel (used in the construction of AIRBUS) are described together with the steel's composition and the corresponding latitudes admissible. The required characteristics are stated. The effects of quenching (air, salt baths, oil) and austenizing on breaking energies and brittle/ductile transition curves are shown. The results of FISSAD on various grade steels, titanium alloys and some other light alloys are also given. Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-26446* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

VITRA-VIOLET PROCESS FOR PRODUCING FLAME RESISTANT POLYAMIDES AND PRODUCTS PRODUCED THEREBY Patent

Madeline S. Toy (Sci. Appl., Inc., La Jolla, Calif.) and Roger S. Stringham, inventors (to NASA) (Sci. Appl., Inc., La Jolla, Calif.) Issued 20 May 1980 4 p Filed 6 Dec. 1976 Supersedes N77-14262 (15 - 05, p 0594) Sponsored by NASA

(NASA-Case-MSC-16074-1; US-Patent-4,203,723; US-Patent-Appl-SN-747674; US-Patent-Class-8-115.5; US-Patent-Class-8DIG.12; US-Patent-Class-8DIG.18; US-Patent-Class-204-159.15; US-Patent-Class-204-159.19; US-Patent-Class-525-426) Avail: US Patent and Trademark Office CSCL 07C

Aromatic polyamides with improved nonflammability characteristics are produced by contacting a polyamide substrate with a gaseous medium comprising a minor amount of a haloolefinic material and an inert diluent in the presence of light having sufficient energy to effect chemical addition of the haloolefin to the polyamide substrate.

Official Gazette of the U.S. Patent and Trademark Office

N80-26447*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LOW TEMPERATURE CROSS LINKING POLYIMIDES Patent Application

Tito T. Serafini and Peter Delviss, inventors (to NASA) Filed 20 Jun. 1980 14 p

(NASA-Case-LEW-12876-1; US-Patent-Appl-SN-161253) Avail: NTIS HC A02/MF A01 CSCL 07C

A way of forming a prepolymer polyimide which can be cross-linked at a relatively low temperature is disclosed. Usually a polyimide is formed by cross linking a prepolymer formed by reacting a polyfunctional ester, a polyfunctional amine, and an end-capping unit. By providing a styrene derivative end-capping unit, the prepolymer is curable at a temperature of about 175 to 245 C. NASA

N80-26448*# Mechanical Technology, Inc., Latham, N. Y.

HIGH TEMPERATURE SELF-LUBRICATING COATINGS FOR AIR LUBRICATED FOIL BEARINGS FOR THE AUTOMOTIVE GAS TURBINE ENGINE Final Report

Bharat Bhushan 1 Jul. 1980 232 p refs

(Contracts DEN3-43; EC-77-A-31-1040)

(NASA-CR-159848; DOE/NASA/0043-2) Avail: NTIS HC A11/MF A01 CSCL 13I

Coating combinations were developed for compliant surface bearings and journals to be used in an automotive gas turbine engine. The coatings were able to withstand the sliding start/stops during rotor liftoff and touchdown and occasional short time, high speed rubs under representative loading of the engine. Some dozen coating variations of CdO-graphite, Cr2O3 (by sputtering) and CaF2 (plasma sprayed) were identified. The coatings were optimized and they were examined for stoichiometry, metallurgical condition, and adhesion. Sputtered Cr2O3 was most adherent when optimum parameters were used and it was applied on an annealed (soft) substrate. Metallic binders and interlayers were used to improve the ductility and the adherence. R.C.T.

N80-26449*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

HIGH-TEMPERATURE ADHESIVES FOR BONDING POLYIMIDE FILM

Anne K. StClair, Wayne S. Slemp, and Terry L. StClair May 1980 28 p refs Presented at the 23rd Natl. SAMPE Symp., Anaheim, Calif., May 1978

(NASA-TM-81824) Avail: NTIS HC A03/MF A01 CSCL 11A

Experimental polyimide resins were developed and evaluated as potential high temperature adhesives for bonding Kapton polyimide film. Lap shear strengths of Kapton/Kapton bonds were obtained as a function of test temperature, adherend thickness, and long term aging at 575 K (575 F) in vacuum. Glass transition temperatures of the polyimide/'Kapton' bondlines were monitored by thermomechanical analysis. Author

N80-26450*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.

A FUNDAMENTAL APPROACH TO ADHESION: SYNTHESIS, SURFACE ANALYSIS, THERMODYNAMICS AND MECHANICS Semiannual Report

Betty Beck, Ranjani Siriwardane, and James P. Wightman Jul. 1980 19 p refs

(Grant NsG-1124)

(NASA-CR-163024) Avail: NTIS HC A02/MF A01 CSCL 11A

Several techniques were used to study pretreated Ti 6-4 surfaces including scanning electron microscopy (SEM), electron spectroscopy of chemical analysis (ESCA), and, reflectance visible spectroscopy. Each pretreatment type gave a characteristic surface morphology as seen by SEM. Elemental analysis of the Ti 6-4 surfaces was done using ESCA. Trace residual contaminants from particular chemical pretreatments were identified readily. Results indicate that reflectance visible spectroscopy using indicator dyes placed on Ti 6-4 surfaces appears to be a feasible approach to establish surface acidity. Differences in surface acidity were observed using bromthymol blue on Ti 6-4 surfaces pretreated by two different methods. R.C.T.

N80-26451*# National Aeronautics and Space Administration, Washington, D. C.

HYDROPHOBIC COATING OF SOLID MATERIALS BY PLASMA-POLYMERIZED THIN FILM USING TETRAFLUOROETHYLENE

Keiichiro Hozumi, Keisuke Kitamura, and Tatsuya Kitade Mar. 1980 17 p refs Transl. into ENGLISH from Yakugaku Zasshi (Japan), v. 99, no. 5, 1979 p 521-527 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Kyoto Coll. of Pharm.

(Contract NASw-3199)

(NASA-TM-75778) Avail: NTIS HC A02/MF A01 CSCL 07C

Glass slides were coated with plasma-polymerized tetrafluoroethylene films of different thickness using the glow discharge technique in a tube-shaped chamber, and the plasma conditions, film growth rates, light permeability of the polymer films, and particle bond strength in the polymer films were studied. Ashed sections of mouse organs and ashed bacillus spores were also coated to give them hydrophobic treatment without damaging their shapes or appearance. The hydrophobic coating of the specimens was successful, and the fine ash patterns were strongly fixed onto the glass slides, making permanent preparations. Author

N80-26452# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio. Materials Engineering Div.

EVALUATION OF POLYIMIDE FLEXIBLE FOAM

W. Paul Robbins Mar. 1980 11 p

(AD-A082742; PTPT-80-6) Avail: NTIS HC A02/MF A01 CSCL 11/9

A 0.5 pcf polyimide flexible foam developed by Solar Turbines International, Division of International Harvester Corp., was evaluated for cushioning and flammability characteristics. The results showed that the dynamic cushioning characteristics were equivalent to 0.5 polyurethane foam at 72 F, superior at -40 F and the foam has improved reuseability. When exposed to a

flame of a bunsen burner the polyimide foam was considered non-burning, with little smoke emission or odor. GRA

N80-26453# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
DYNAMIC FRACTURE IN VISCOELASTIC SOLIDS Annual Report, Aug. 1978 - Aug. 1979
Mool C. Gupta and Wolfgang G. Knauss Mar. 1980 53 p refs
(Contract N00014-78-C-0634)
(AD-A083809; GALCIT-SM-80-5; AR-1) Avail: NTIS HC A04/MF A01 CSCL 11/9

The purpose of our studies is to gain fundamental information on the failure of elastomers, both unfilled and filled with particulate material; specially to determine the amount of fragmentation that occurs on failure under dynamic conditions. Experimental information sought relates to crack velocity and crack branching. At present we are studying the onset of crack propagation, and possible crack branching in elastomers using high speed cinematography under loads induced with an electromagnetic loading device. In this report we describe the material preparation, experimental technique and some preliminary results obtained on crack growth in Solithane (a polyurethane elastomer). GRA

N80-26454# Bendix Corp., Kansas City, Mo.
EFFECTS OF HUMIDITY DURING PHOTOPROCESSING ON THIN FILM METALLIZATION ADHESION
D. P. Norwood Mar. 1980 46 p ref
(Contracts EY-76-C-04-0613; DE-AC04-76DP-00613)
(BDX-613-2312) Avail: NTIS HC A03/MF A01

Humidity effects during photoprocessing on tantalum/chromium/gold thin film networks (TFNs) were investigated. Humidity conditions at various process steps were controlled by placing either desiccant or water in handling containers for the TFNs. The TFNs photoprocessed in humid conditions had a much higher occurrence of metallization failures compared to TFNs processed in dry conditions. Ceramic surface defects were shown to cause pores in the thin films, and these pores enhanced corrosion susceptibility for the films. A desiccated storage process for production of TFNs were developed. DOE

N80-26455# Florida Univ., Gainesville. Dept. of Electrical Engineering.
INFLUENCE OF GRAIN BOUNDARIES ON RECOMBINATION IN POLYSILICON PN-JUNCTION SOLAR CELLS
J. G. Fossum, A. Neugroschel, F. A. Lindholm, and J. A. Mazer 1980 7 p refs Presented at 14th IEEE Photovoltaic Specialists Conf., San Diego, Calif., 7-10 Jan. 1980
(Contract ET-78-C-01-3421)
(CONF-800106-24) Avail: NTIS HC A02/MF A01

The physics controlling recombination in polysilicon pn-junction cells is described. Analytic models characterizing this recombination, whose parameters can be related directly to experiment, are developed. The analysis reveals that, in general, the description of intra-grain and grain-boundary recombination in a polysilicon solar cell requires the solution of a nonlinear, three-dimensional boundary-value problem. Cases of practical interest for which this problem is tractable are discussed. The analysis predicts an exp(qV/2kT) dependence (the reciprocal slope factor is exactly two) for carrier recombination at a grain boundary within the junction space charge region of a nonilluminated, forward based cell. This result, and others of the analysis, are shown to be consistent with measured current-voltage characteristics of pn junctions fabricated on polycrystalline silicon. DOE

N80-26456# Cities Service Oil Co., Tulsa, Okla.
EL DORADO MICELLAR-POLYMER DEMONSTRATION PROJECT Progress Report, Sep. 1978 - Aug. 1979
G. W. Rosewald, ed. and W. D. Howell (Bartlesville Energy Technology Center, Okla.) Feb. 1980 242 p refs
(Contract ET-78-C-03-1800)
(DOE/ET-13070/53; AR-5) Avail: NTIS HC A11/MF A01

The micellar fluid injection was completed in the north (Chesney) pattern, and injection of polymer solution was initiated. Polymer solution was injected into the south (Hegberg) pattern. Fluid movement at the observation wells has been monitored closely. Oil mobilization has been indicated by the detection of an oil bank moving past some of the observation wells in both patterns. No significant changes in fluid composition have occurred at the eight production wells. Three flow tests designed to define the optimal salinity for the north pattern polymer drive were made using El Dorado 650 ft Sandstone cores. Results of these tests indicated that a polymer drive with 1.0 wt %. NaCl in El Dorado lake water has the highest oil recovery efficiency. The pressures in the project monitoring wells were measured four times. Two sets of pressure transient tests were conducted to determine the extent of a hydraulic fracture. An estimate of recovery efficiency was made based on the updated calculations and the data taken for the one foot interval at well MP 131. These preliminary results showed about 40% displacement efficiency. DOE

N80-26457# Sandia Labs., Albuquerque, N. Mex.
DEMIXING PROBLEMS IN POLYMERS
J. F. Joanny Nov. 1979 108 p refs Transl. into ENGLISH of "Problemes de Demmixtion dans les Polymeres", Ph.D. Thesis, Paris 6 Univ., Oct. 23, 1980 108 p
(SAND-80-6000) Avail: NTIS HC A06/MF A01

Phase transitions in polymers were studied. Emphasis was place on the following: Flory-Huggins theory and experiment; critical demixing properties; effects of polydispersion; and two dimensional systems. DOE

N80-26458# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
USE OF HIGH PERFORMANCE POLYMERS IN THE AEROSPACE INDUSTRY [UTILISATION DES POLYMERS PERFORMANTS DANS L'AEROSPATIALE]
J. P. Bentejac 10 Aug. 1979 10 p In FRENCH Presented at Symp. sur les Polymers a Hautes Performances et leurs Appl. Recentes, 7 Nov. 1978
(SNIAS-792-551-104) Avail: NTIS HC A02/MF A01

The applicability of polymers to various fabricated parts and structures is discussed from both the technical and financial point of view. The factors determining the choice of materials are reviewed together with the evolution in such materials over recent years. A table is given showing the interdependance between mechanical and thermal characteristics, various behavior properties, economic parameters and specific applications. The different characteristics and applications (aircraft, ballistics missiles, helicopters, etc.) of the various different thermosetting plastics are described. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-26459# California Univ., Irvine.
COMPARATIVE METABOLISM OF PROPELLANT HYDRAZINES Annual Report, 1 Jun. 1978 - 31 May 1978
Ronald C. Shank Wright-Patterson AFB, Ohio AMRL Aug. 1979 50 p refs
(Contract F33615-76-C-5005)
(AD-A074634; AMRL-TR-79-57) Avail: NTIS HC A03/MF A01 CSCL 21/9

Co-administration of hydrazine and 14C-methyl-methionine to rats and mice resulted in the methylation of liver DNA at the 7-position of guanine; this methylation occurs rapidly and was detectable one after hydrazine administration. No 7-methylguanine was found in animals given 14C-methyl-methionine alone. Administration of monomethylhydrazine (MMH) resulted in the formation of 7-methylguanine in rat and mouse liver DNA but not in DNA from other tissues: MMH served indirectly as the methyl donor. Administration of 1,1-dimethylhydrazine (UDMH) does not result in DNA methylation. The pattern DNA methylation by hydrazine and MMH was not similar to that produced by 1,2-dimethylhydrazine (SDMH), a strong carcinogen. MMH and UDMH were metabolically oxidized to CO2 at different rates by various tissues from rats, mice, and hamsters. Deoxyribonucleic acid methylation in animals treated with propellant

hydrazines, to determine whether the nitrogen atoms in these hydrazines form adducts with tissue DNA, and to identify all adducts formed by mass spectrometry was examined. B.D.

N80-26460*# National Aeronautics and Space Administration. Pasadena Office, Calif.
AUTOCATALYTIC COAL LIQUEFACTION PROCESS Patent Application
Shaik A. Qader, inventor (to NASA) (JPL) Filed 28 Jan. 1980 31 p Sponsored by NASA
(NASA-Case-NPO-14876-1; US-Patent-Appl-SN-116310) Avail: NTIS HC A03/MF A01 CSCL 21D

An improved process is disclosed for liquefying coal in which coal minerals at high content are utilized as a hydrocracking catalyst. A slurry of 10 to 60% by weight of coal in recycled liquefied coal product which contains 15% to 30% by weight of coal minerals, is pressurized with excess hydrogen to a pressure of 2,000 to 4,000 psi and heated to a temperature of 450 to 550 C. The coal minerals autocatalytically convert coal solids to a low viscosity liquid product and to gas product in high yields while reducing oxygen, nitrogen and sulfur content of the coal product as compared to other coal liquefaction processes under development. NASA

N80-26461# Pittsburgh Energy Technology Center, Pa.
THE 2ND INTERNATIONAL SYMPOSIUM ON COAL-OIL MIXTURE COMBUSTION, VOLUME 2
1979 689 p refs Symp. held at Danvers, Mass., 27 - 29 Nov. 1979 Sponsored by DOE 2 Vol.
(CONF-791160-Vol-2) Avail: NTIS HC A99/MF A01

Technologies associated with coal oil mixtures (COM) are assessed. Production of COM, including techniques as well as equipment used, properties of the mixture, and additives needed for stabilization are discussed. Combustion efficiencies and byproducts are also studied. For individual titles, see N80-26462 through N80-26487.

N80-26462# Pennsylvania State Univ., University Park. Mineral Processing Section.
GRINDING OF COAL IN OIL
P. T. Luckie and P. S. Bagga *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 20 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

Grinding kinetic parameters were determined in various fluids for three typical coals. It was found that the breakage action parameters for all of the coals did not change with environment as previously thought. Measurements of power draw of the test batch mill were also made. The implications of these findings to industrial results are discussed. Fuel oil as a grinding fluid appears to create a more sensitive tumbling action condition, and hence, lifter configuration and operational critical speed may be more critical. In addition, heating the fuel oil may achieve results similar to grinding the coal in water. E.D.K.

N80-26463# Transamerica Delaval, Inc., Crystal River, Fla. Imo Pump Div.
HANDLING COAL OIL MIXTURES WITH POSITIVE DISPLACEMENT PUMPS
Timothy W. Mabes, Sr. *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 5 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The use of two and three screw positive displacement pumps for use with coal oil mixtures is discussed. Particular attention is given to both the location of wear that occurs within these pumps as well as its effect on volumetric performance. consideration is also given to the economics involved for coal oil mixture pump packages versus conventional fuel oil pump packages. E.D.K.

N80-26464# Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
GRINDING OF COAL-IN-OIL SLURRIES
O. Trass and G. Papachristodoulou *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 28 p refs Prepared in cooperation with General Comminution Inc., Don Mills, Ontario (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

Grinding of coal in fuel oil for COM preparation is simpler and may give better slurry properties than dry grinding followed by dispersion in oil. A 42 weight percent slurry of 600 to 840 micrometer monosize of hard Pittsburgh coal in No. 2, No. 4, and No. 6 fuel oils was ground with the Szego mill. Particle size distributions at different residence times are reported down to a 10 micrometer mean size, along with energy consumption data. Low mill hold ups and high rotational speeds enhanced the rate of grinding. E.D.K.

N80-26465# New England Power Service Co., Westborough, Mass.
DEVELOPMENT OF STANDARDS FOR COAL-OIL MIXTURES
Sushil K. Batra and Roy C. Kurtzrock (Pittsburgh Energy Technol. Center) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 6 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

As the coal oil mixture technology nears it commercialization, there is a need for uniform performance criteria, testing procedures, and quality control for trouble free and reliable utilization of this technology. Also, various terminologies associated with this technology need to be defined more precisely to have more meaningful application. With this in view, a Standards and Practice Committee was formed to establish criteria for process equipment, instrumentation, characterization of the coal oil mixtures, and combustion characteristics with respect to industrial and utility application of coal oil mixtures, as well as to develop guidelines and procedures considering feasibility from the standpoints of both cost and engineering. The goals and objectives of this committee with special reference to the various efforts underway in the area of development of standards and procedures are presented. E.D.K.

N80-26466# Dravo Corp., Pittsburgh, Pa.
PROGRESS IN DEVELOPING ULTRAFINE COAL-OIL MIXTURES
F. R. Sell and J. W. Cochran (Florida Power Corp., Crystal River) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 23 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

A comparison between ultrafine COM and 200 mesh COM shows that ultrafine COM has many potential advantages, such as low settling rate, minimization of equipment erosion and abrasion, reduction of boiler ash related problems, and beneficiation potential. Despite high grinding costs, the total cost of ultrafine COM fuel compares favorably with 200 mesh/additive COMs. Work on the fluid mill grinding approach for preparing ultrafine (100% minus 325 mesh) COM was continued. A technical development program to address energy consumption, mill wear, and scale-up of COM fuels for U.S. and foreign user evaluations was created. Plans are discussed concerning the building of a COM preparation plant for producing large quantities of demonstration fuel. E.D.K.

N80-26467# Massachusetts Univ., Amherst.
COAL-OIL MIXTURES 4: SEDIMENTATION AND SUBSIDENCE STUDIES OF THE STABILITY AND STRUCTURE OF COAL-OIL MIXTURES
R. L. Rowell, B. J. Marlow, T. S. Tsai, Sushil K. Batra, and J. R. Pitman (New England Power Co., Salem, Mass.) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 21 p refs Sponsored by Elec. Power Res. Inst. Prepared in cooperation with New England Power Service Co., Westborough, Mass. (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The limits of the sedimentation column method are explored and the techniques of sedimentation and subsidence are applied to long term studies of the stability and structure of coal oil mixtures. Significant environmental effects are considered, especially the effect of carbon dioxide as a blanketing gas. It is shown that sedimentation and subsidence measurements are a

sensitive probe of the stability and structure of coal oil fluids. The importance of the concept of a critical solids concentration is shown and model studies of stabilized and unstabilized COM at high concentration are given. Preliminary test results of slurry samples from various locations in the system are presented and compared to samples produced at the laboratory. The standard tests include determination of solid concentration, particle size distribution, sedimentation column drain time and sedimentation column bottom compaction. E.D.K.

N80-26469# Tufts Univ., Medford, Mass. Dept. of Chemical Engineering.
CHARACTERIZATION AND STRUCTURAL STUDIES OF THE VARIOUS TYPES OF COM
G. D. Botsaris, Y. M. Glazman, M. Adamo-Viola, P. S. Goldsmith, and R. J. Haber *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 37 p refs (For primary document see N80-26461 17-28)
(Contract DE-AS01-78ET-10746)
Avail: NTIS HC A99/MF A01

The surface properties of coal, specifically its philicity or oleophilic/hydrophilic nature, are important parameters governing both the aggregative and sedimentative stability, the structure, and the rheology of COM. Moreover, it is contended that the surface properties of the coal are not only important in COM which contain additives but also in those which do not. The rheology and stability properties of various COM formulations prepared with different coals were investigated. Three parameters, a sedimentation number, an aggregation number, and a gelation number were developed to concisely reflect the results of the rheological and stability tests. An attempt was made to develop a model to explain the effect of additives on the structure, stability, and rheological properties of COM prepared from coals having different surface properties. E.D.K.

N80-26489# New England Power Service Co., Westborough, Mass.
FEASIBILITY STUDY OF USING A COAL/OIL/WATER EMULSION AND COAL/OIL MIXTURES AS CLEAN LIQUID FUELS 2
S. Y. Tsai, S. K. Batra, John P. Dooher (Adelphi Center for Energy Studies), Richard W. Genberg (Adelphi Center for Energy Studies), Sung Moon (Adelphi Center for Energy Studies), Donald Wright (Adelphi Center for Energy Studies), Steven E. Jakatt (Adelphi Center for Energy Studies), Barbara J. Gilmartin (Adelphi Center for Energy Studies), Donald Albert (Adelphi Center for Energy Studies), and Carl Denauski (Adelphi Center for Energy Studies) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 13 p (For primary document see N80-26461 17-28)
(Contract DE-AC22-79PC-10328)
Avail: NTIS HC A99/MF A01

The rheological and combustion properties of coal-water-oil mixtures were investigated and the use of alkaline additives to remove the sulfur oxide gases were studied. Results on stability and pumpability indicate that mixtures of 50% by weight of coal and stoichiometric concentrations of alkaline absorbents are pumpable. Correlation between viscometer data and pumping data follows a power law behavior for these mixtures. Thermal efficiencies are about the same as for pure oil. Combustion efficiencies are approximately 97%. It is possible to remove in a small scale combustion from 50 to 80% of the sulfur dioxide gases. E.D.K.

N80-26470# Germantown Labs., Inc., Philadelphia, Pa.
THE PRODUCTION OF STABLE COAL-OIL MIXTURES USING HIGH INTENSITY MECHANICAL MIXING DEVICES
C. S. Stokes and N. H. Cherry *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 28 p ref (For primary document see N80-26461 17-28)
(Contract DE-AC77-ET-10634)
Avail: NTIS HC A99/MF A01

The use of four different commercially available high intensity mechanical mixing devices to produce stable coal-oil-water mixtures were investigated. The four types of mixing devices used included a Gaulin Corporation Model 15 Homogenizer, a Sonic Corporation Triplex 1000A, a Branson Sonic Power Model 190 Ultrasonic Processing System, and a Total (French) System. The stability of a coal-oil-water mixture up to 45% coal loading was evaluated by a K-scan unit. A detailed description of the parameters and operating conditions for producing the stable mixtures using the four different units is presented. The Gaulin unit proved to be the most versatile unit producing stable 45% coal loaded materials using single pass operation. The unit also produced relatively stable 30% coal loaded mixtures using a recycle mode. The Sonic unit and the Branson equipment produced similar stable emulsions, and either apparatus could be used for 45% coal loaded mixtures. The Total system produced only stable emulsions using 45% coal loaded mixtures under recycle operation. M.G.

N80-26471# Adelphi Univ., Garden City, N. Y.
RHEOLOGICAL PROPERTIES OF SOLVENT REFINED COAL-OIL MIXTURES
John P. Dooher, E. P. Foster (Air Products/Wheelabrator-Frye Joint Venture), A. S. Gudta (Air Products/Wheelabrator-Frye Joint Venture), and C. M. Kelly *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 p 1-14 Prepared in cooperation with Villanova Univ., Pa. (For primary document see N80-26461 17-28)
(Contract DE-AC05-78OR0-3054)
Avail: NTIS HC A99/MF A01

The rheological properties and stability of various mixtures of solvent refined coal (SRC) solid in No. 6 oil and one mixture with No. 5 oil are investigated. The apparent viscosity was measured as a continuous function of shear rate by a rotoviscometer. Suspension settling stability was assessed by using a pendulum-period technique. The mixtures were found to differ somewhat from coal-oil mixtures of equivalent composition. SRC solid-oil mixtures are non-Newtonian, with an apparent viscosity significantly higher than coal-oil mixtures of equivalent composition. Except for very finely divided SRC particles at low shear rate, all mixtures tested are considered pumpable. There is apparently no significant reaction between SRC solid and the oil, as indicated by a lack of change of viscosity with time. Mixtures of SRC solid and oil alone settled somewhat. Mixtures stabilized by emulsification with water or addition of surfactant are felt to be sufficiently stable for commercial use. Of the mixtures tested, an emulsion of 47 wt% SRC solid, 47 wt% No. 6 oil, and 6 wt% water is considered the best. M.G.

N80-26472# Pittsburgh Energy Technology Center, Pa.
THE ROLE OF COAL AND OIL CHARACTERISTICS IN THE STABILITY OF COAL-OIL MIXTURES
J. M. Ekmann and D. Bienstock *In its* the 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 30 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The effect of coal type and oil type on the settling behavior of coal-oil mixtures (COM) is examined. Some discussion on the role of dispersion method and addition of water is included. The effect of oil chemistry and viscosity on settling was examined for five No. 6 oils - a correlation was found. Viscosity of the No. 6 oil strongly influenced COM viscosity, while no significant difference was found for several coals. Simple models for the shear stress-shear rate relationship were fit to available data - significant deviation from the models were found for high coal loadings. A simple model for settling is discussed. M.G.

N80-26473# Kentucky Univ., Lexington. Institute for Mining and Minerals Research.
EVALUATION OF 'STABLE' EMULSIONS OF COAL
T. T. Coburn *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 25 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

A method of testing the long term stability of coal/oil/water emulsion samples is described. The emulsions investigated were commercial coal/oil/water mixtures, 55/35/10 by weight, prepared by an ultrasonic emulsifying method. Apparent viscosity determination proved to be a convenient method of sample evaluation. A rotational type viscometer was used, and a method based on an expression which had previously been used to determine the concentration of solids in latex dispersion was

applied: Log(apparent viscosity) = a Log(Spindle speed) + b. For emulsion samples from which solids settled slightly over a period of time, the weight percent solids as a function of depth could be related to the a term in the expression. At low spindle speeds it was more convenient to relate apparent viscosity and concentration of solids directly. A gravimetric method which required isolation of the dry coal solids was used to check the viscometry results. M.G.

N80-26474# Dow Chemical Co., Midland, Mich.
STABILIZATION OF COAL/FUEL OIL SLURRIES
W. C. Meyer *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 15 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

Water as an effective means of stabilizing coal-oil mixtures (COM) against settling by acting as a flocculating third phase is examined. Wetting agents are found to enhance the flocculating efficiency of water by increasing the cross sectional area of contact between coal particles, as evidenced by increased static yield values--a measure of particle-particle interaction. At excessive levels of wetting agent, the more favorable wetting of the hydrophobic surface of coal by water is counterbalanced by greatly reduced interfacial tensions between water and oil. Some loss of flocculating efficiency occurs. The effect of particle size distribution, solids content, type of fuel oil, and type of coal (having a highly oxidized surface), along with the substitution of formamide in place of water as the flocculating third phase, are briefly examined to further define the stabilizing influence of water in COM. Possible adverse consequences of continuous agitation or recirculation on COM stability dervied via this means are pointed out. M.G.

N80-26475# Kawasaki Heavy Industries, Ltd., Akashi (Japan).
RESULTS OF EXPERIMENT PRODUCTION OF FINE COM BY WET TYPE MILL
Noboru Sato *In* Pittsburgh Energy Technol. Center The 2nd Inter. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 28 p ref (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The experimental production of fine coal-oil mixtures (COM) with a wet type mill using four kinds of bituminous coal together with Middle East heavy crude oil is discussed. The following results were obtained: (1) the holdup of COM in the mill has an important influence on grindability; (2) all types of coal submitted to the tests presented good grindability; (3) the coal density of 50% and 55% presented satisfactory grindability; (4) the temperature of COM during the pulverizing process should be as high as possible; (5) an increase in the production rate coarsens the particle size distribution of COM almost linearly; (6) when total moisture content of the crushed coal is of the order to 10% or less, it was confirmed that the residual moisture content of COM can be dewatered to approximately 2%, by heating the heavy oil supplied to the mill. M.G.

N80-26476# Hitachi, Ltd., Tokyo (Japan). Shipbuilding and Engineering Div.
FINE COM PREPARATION TEST
Masazumi Yanase *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 32 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

Tests designed to determine the coal-oil mixture (COM) preparation conditions required to attain a satisfactory COM stability with a line mixer are discussed. The results indicate that, in premixing, the time between injection of the additive and agitation in the line mixer should be as short as possible. However a macroscopically homogenous mixing by agitation, as well as the method of injection of additive are necessary and important factors. Preparation using a line mixer gives better results compared with other preparation methods. In the preparation of COM with a line mixer, both specific agitation energy and turbine blade edge speed exceeding definite values are required. The optimum COM preparation conditions are different according to the additive, but these differences are not very pronounced. M.G.

N80-26477# Dai-ichi Kogyo Seiyaku Co. Ltd., Tokyo (Japan).
THE USE OF ADDITIVES TO STABILIZE COAL-OIL MIXTURE
Akihiro Naka *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 44 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The performance of additives intended to stabilize oil-coal mixtures (COM) is discussed. Approximately 1,300 types of additives were mixed more than 10 different COM and the obtained mixture was poured into a cylinder in order to measure precipitation of the coal particles after stall storage at a temperature of 70 C. As a result of these tests, several types of additives with excellent stabilizing effects were idscovered. The effectiveness of these stabilizers in the COM was tested under various conditions, i.e., vibration, heat, freezing, and agitation. Based on these tests, the additive presenting the best results was selected (ACOM). The addition of approximately 0.1 wt% of ACOM to a mixture, without addition of water, resulted in more than 10 types of COM stable for periods of one to two months and showing, in addition, excellent economic characteristics. M.G.

N80-26478# Neos Co. Ltd., Tokyo (Japan).
COM STABILITY FORECASTING METHOD
Yoshikazu Ogura *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 32 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

From a discussion of a stable system model composed of coal-oil mixtures (COM) with addition of an additive, a method for evaluating long term stability of the system, by measuring the quantity of additive distributed in the COM immediately after production is devised. The distribution forms considered are (1) additive dispersed and dissolved in the oil medium; (2) additive absorbed in the coal; and (3) additive present on the surface of coal. In case of using additive NEOS N-1, if the quantity of additive present on the surface of the coal exceeds 1,000 micro-g/coal-g experimental results demonstrate that the COM in question is able to remain as a stable system, even when still-stored for more than one month. M.G.

N80-26479# Kao Soap Co. Ltd., Tokyo (Japan).
STUDIES ON THE STABILIZATION OF COM
Masaaki Yamamura, Tatsuji Yamashita (Lion Fat and Oil Co. Ltd., Tokyo), and Teizo Igarashi (Nippon Oil and Fat Co. Ltd., Tokyo) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 57 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

Stabilizers for coal-oil-mixtures (COM) and related technologies were developed. Emphasis was placed on developing stabilizers to minimize the sedimentation of coal particles contained in the COM. The factor influencing COM stability were determined and measures to cope with the variations occurring in the these factors were surveyed R.C.T.

N80-26480# Electric Power Development Co. Ltd. (Japan).
FINE AND COARSE COAL OIL MIXTURE COMBUSTION TESTS OF AIR ATOMIZED BURNER IN JAPAN
Y. Nakabayashi and Donald J. L. Lin, P. E. (Forney International, Inc.) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 24 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

A tristage air atomized burner was tested at the facilities of the three leading boiler makers in Japan. Coal oil mixtures (COM) of 50/50 weights with both fine and coarse coal particles were tested under conventional excess air and modified off-stoichiometeric combustion modes. Nitrogen-oxygen reduction techniques via flue gas recirculation and two stage off-stoichiometric combustion were confirmed. Coal-oil-mixture combustion characteristics were compared to those of heavy oil. R.C.T.

N80-26481# Atlantic Research Corp., Alexandria, Va.
DEVELOPMENT AND EVALUATION OF HIGHLY-LOADED COAL SLURRIES

R. S. Scheffee and E. T. McHale *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 14 p refs (For primary document see N80-26461 17-28)
(Contract DE-AC01-77-ET-13041)
Avail: NTIS HC A99/MF A01

Highly loaded coal slurry fuels were developed and evaluated. Slurry fuels comprised of either bituminous, subbituminous, or lignite coal and either aqueous media or emulsions of No. 6 oil in water as the carrier were examined at solids loadings up to 70% by weight. The water slurries of bituminous coals were emphasized. These slurries were developed for use in place of No. 6 oil in oil fired burners, and represent a companion concept to coal-oil-mixtures. R.C.T.

N80-26482# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
ATOMIZATION OF COAL SLURRY JETS
T. Butcher, A. Pucci, and C. R. Krishna *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 13 p refs (For primary document see N80-26461 17-28)
(Contract EY-76-C-02-0016)
Avail: NTIS HC A99/MF A01

Jet length and drop size were examined for water and No. 2 oil slurries up to 30% concentration. Preliminary data from an air-atomized nozzle are presented for illustration. R.C.T.

N80-26483# Wayne State Univ., Detroit, Mich. Dept. of Mechanical Engineering.
ATOMIZATION OF COAL-OIL MIXTURES
S. Cermi and M. R. Ghaseemzadeh *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 17 p refs (For primary document see N80-26461 17-28)
(Grant DE-FG01-77-ET-10658)
Avail: NTIS HC A99/MF A01

Atomization characteristics of coal-oil mixtures were studied by an experimental set up consisting of an airblast atomizer fed from a flow control rig, which discharges through a spray channel into a storage tank. Vapors generated were removed via an exhaust system. The fully developed spray was photographed at different axial locations using 35 mm camera fitted with a microflash designed for high speed photography. Slides and prints were analyzed for particle size distribution. R.C.T.

N80-26484# Mitsubishi Heavy Industries Ltd., Tokyo (Japan).
BASIC STUDIES ON COM COMBUSTION
U. Takahashi, H. Hino, U. Fujima, and A. Komori *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-oil Mixture Combust., Vol. 2 1979 29 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

Special appropriate conditions necessary for the satifactory atomization of the coal-oil-mixture (COM) were examined. The conditions preventing the atomizer, which has very narrow passages for transporting the COM, from clogging in order to achieve stable operation was studied. The feasibility of the technological development aiming at coping with that problem was investigated. R.C.T.

N80-26485# Hitachi, Ltd., Tokyo (Japan).
REPORT ON FINE COM COMBUSTION TEST
Hitoshi Migaki *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-oil Mixture Combust., Vol. 2 1979 15 p (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The utilization fine coal-oil mixtures transported as a fluid and as a fuel for boilers was investigated. Major emphasis was placed on the combustion, the nitrogen-oxygen countermeasures (i.e., two stage combustion), and the recirculation of gas mixing combustion. R.C.T.

N80-26486# Methacoal Corp., Dallas, Tex.
THE CFOS (CARBONACEOUS FUEL-IN-OIL SUSPENSOIDS) FUELS
Leonard J. Keller *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combustion, Vol. 2 1979 16 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

The methods producing carbonaceous fuel-in-oil suspensoid fuels are discussed. It is shown that most of the CFOS fuels, if made from pulverized coal, although not as completely stable as those made from CHC fuels, are relatively stable compared to other coal-oil-mixtures fuels. R.C.T.

N80-26487# Argonne National Lab., Ill.
COAL/OIL MIXTURE PIPELINE: A VIABLE ALTERNATIVE COAL TRANSPORTATION SYSTEM?
J. Harkness, B. L. and L. J. Petrovic (Resource Engineering, Inc.) *In* Pittsburgh Energy Technol. Center The 2nd Intern. Symp. on Coal-Oil Mixture Combust., Vol. 2 1979 22 p refs (For primary document see N80-26461 17-28)
Avail: NTIS HC A99/MF A01

A coal transportation system which utilizes coal/oil mixture technology is compared to the coal/water system and to another alternative, coal/ methanol system. Major emphasis is placed on the system design considerations and trade-offs, the resource requirements (including capital), and the cost of delivered energy. The system environmental impacts, the status of the technologies, oil quality and supply, and the potential system flexibilities are discussed qualitatively. R.C.T.

N80-26488# European Space Agency, Paris (France).
EXPLOSIVES AND PYROTECHNICS: SPACE APPLICATIONS
W. R. Burke, ed. and J. Mort, ed. Jan. 1980 361 p refs Partly in FRENCH and ENGLISH Presented at ESA/CNES Intern. Colloq., Toulouse, 23-25 Oct. 1979
(ESA-SP-144; ISSN-0379-6566) Avail: NTIS HC A16/MF A01; ESA, Paris FF 75

Pyrotechnic components and systems are discussed in terms of fundamental theory modeling, and experimentation. Major emphasis is given to reliability theory and applications. For individual titles, see N80-26489 through N80-26523.

N80-26489# Poitiers Univ. (France). Groupe de Recherches de Chimie Physique de la Combustion.
PHYSICAL CHEMISTRY OF PYROTECHNIC REACTIONS
M. L. Bernard *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 3-14 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Experimental and theoretical considerations are developed concerning pyrotechnic components and systems. Included are systems whose main function is the conversion of an external excitation, and pyrotechnic systems and devices having varied functions (instantaneous mechanical action, generation of gases, illumination, masking and labeling). Emphasis is given to the following phenomena: combustion, solid-solid reactions, reactions without gas, thermochemical behavior; chemical kinetics; and heat diffusion. The properties of some specific pyrotechnic materials are also presented. Author (ESA)

N80-26490# Societe Europeenne de Propulsion, Bordeaux (France).
MEASUREMENT OF THE COMBUSTION ENERGY OF PYROTECHNIC COMPOSITIONS BY DIFFERENTIAL SCANNING CALORIMETRY
Georges Krassoulia, Michel Bourgeon, and Joel Bonnete *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 15-19 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The advantages of the calorimeter are discussed with emphasis on its ease of utilization, rapid operation, safety and accuracy. The design and structure of the apparatus are also described. Topics included are: detector, electronic equipment, gaseous atmosphere control system, recorder, and sample holding crucibles. R.C.T.

N80-26491# Poitiers Univ. (France). Groupe de Recherches de Chimie Physique de la Combustion.
RECENT ADVANCES IN THE KINETIC THEORY OF DETONATION
M. Auzanneau, E. Boysset, and M. L. Bernard *In* ESA Explosives

and Pyrotech.: Space Appl. Jan. 1980 p 21-28 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

A correlation is established between the ideal detonation velocity of an explosive and its molecular properties. Molecular volumes of fresh explosive and shock waves (activated complex) are calculated with empirical addition rules using volume increment values cited in previous publications for both liquids and solids. It is shown that only groups with fragile bonds (explosophores) are compressed. Results indicate that it is possible to calculate detonation velocities for condensed explosives and their mixtures. The complementary nature of the kinetic theory of detonation and hydrodynamic theory is also demonstrated. Author (ESA)

N80-26492# Societe Europeenne de Propulsion, Bordeaux (France).
EXPERIMENTAL STUDY AND MODELING OF THE IGNITION OF SOLID PROPERGOL-DRIVEN MOTORS
Pierre Thebault, Joel Guernigou (ONERA, Paris), and Pierre Gerard Mentre (ONERA, Paris) *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 29-40 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Multidimensional Navier-Stokes equations to predict the ignition phases of solid-propellant motors were developed. Data were obtained from flux measurements made during previous work on equivalent motors or from special tests on models of the motor under study. Special miniaturized devices for measuring flux and detecting local propellant ignition (flux meters, photodiodes, impedance probes) were also developed. Author (ESA)

N80-26493# Poitiers Univ. (France). Groupe de Recherches de Chimie Physique de la Combustion.
PRESSURE GRADIENT KINETIC ANALYSIS IN BOMB TESTS WITH SOME PYROTECHNIC COMPOSITIONS. APPLICATION TO THEIR CHARACTERISTICS
J. L. Carreau and M. L. Bernard *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 41-49 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The pressure rise law is analyzed as a function of time. The adiabatic combustion of the Al NH_4ClO_4 system initiated by a primary composition is studied. The straight lines obtained from the equation developed makes it easy to extract the reaction gain and the initial time, and to anticipate how these parameters may possibly be affected by the relative masses of principal and initiating compositions. Author (ESA)

N80-26494# Dynamit Nobel A.G., Troisdorf (West Germany).
NEW ELECTRIC PRIMERS BASED ON METALLIC FILM TECHNOLOGY AND A DISCUSSION OF THEIR CHARACTERISTICS
U. Brede *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 51-56 (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The advantages and disadvantages of gap type and bridge wire type devices are discussed. Metal film technology combines the advantages of both types of device. The production of the device is described and the construction of two metal layer initiators is reported. A series of typical electrical characteristics is given for one of the igniters (dc and h.f.). Author (ESA)

N80-26495# Societe Nationale des Poudres et Explosifs, Vert-Le-Petit (France). Centre de Recherches du Bouchet.
DELAY CORDS
L. R. Guy and P. P. Cord *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 57-61 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Delay fuses were manufactured using a metal sleeve technique. These fuses have a diameter of about 2 mm and may have burning rates as low as 2 mm/sec, with excellent linearity and a low temperature coefficient. Other fuses having higher burning rates (up to 25 mm/sec) were also studied. It is shown that a detonation order can be retransmitted by incorporating a transition relay at the delay mechanism outlet, which exclusively loaded with secondary explosive converts the combustion signal into detonation. Author (ESA)

N80-26496# Societe Nationale des Poudres et Explosifs, Sorgues (France).
HEXANITROSTILBENE FOR PYROTECHNIC APPLICATIONS
Jean-Marie L. Emeury *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 63-68 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

A reliable continuous process for manufacturing hexanitrostilbene (HNS) is described. The HNS, which is obtained by recrystallization from nitric acid has the correct form and grain size distribution for pyrotechnic applications. The apparatus used (rapid mixing type, e.g., injector followed by reactor nozzle) is briefly described. The injector enables a reagent mixture to be obtained in less than one second with rigorous temperature control (1 C). The nozzle presents the following advantages: considerable increase in reagent exchange surface/volume ratio; increase in reacting fluid flow rate; and avoidance of fresh reagent mixing with intermediate reaction products. Author (ESA)

N80-26497# Commissariat a l'Energie Atomique, Paris (France).
SOME THERMOSTABLE BOOSTER EXPLOSIVES: SYNTHESIS AND PROPERTIES
J. C. Adenis, C. Kassel, G. Poulain, J. Soral, and C. Michaud *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 69-76 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Certain nitrated and picrylated heterocyclic compounds were synthesized and studied. The general synthesizing sequence consists of picrylation followed by nitration with nitric acid. These products have an excellent thermostability equal to or even exceeding that of hexanitrostilbene. Their ability to be initiated by an exploding wire was investigated: only DNDPF was initiated with 10kv, PYX deflagrated in excess of 6 kv, HNS and BTX did not react. All the explosives reacted positively when hit with a projectile. Author (ESA)

N80-26498# Societe Nationale des Poudres et Explosifs, Vert-Le-Petit (France). Centre de Recherches du Bouchet.
POURABLE, COMPRESSIBLE, AND MACHINABLE EXPLOSIVES FOR MISSILE APPLICATIONS
C. Maurin *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 77-84 refs (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Detonation tests were conducted on three compositions after exposure to various climatic conditions. A B2150, containing octogene, thermostable, and employing a silicon binder, and a B2151, having a small critical diameter and high power were unaffected by the environmental tests. A third composition, P12044, a compressed product exhibited temperature behavior characteristics better than those of hexanitrostilbene, together with good detonation properties as well as good booster characteristics. Author (ESA)

N80-26499# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
SHOCK WAVES: KNOWLEDGE, USE AND PROTECTION
C. Mas *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 91-100 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The use of one and two dimensional computer programs for detonation studies (wave propagation) is described. Experimental work encountered in the literature is presented together with the results of accelerometry measurements made to define shock spectra envelopes recorded on missile and missile launching structures. The way in which pyrotechnic shock effects on materials are predetermined is discussed. Mathematical modeling techniques and the appropriate calculations which enable the pyrotechnic forces to be understood and exploited are examined.
Author (ESA)

N80-26500# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.

MECHANICAL SAFETY SCREENS FOR DETONATION STUDIES: CALCULATIONS AND OPTIMIZATION

J. P. Dumont and A. Langellier *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 101-106 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Analytical means (modeling the various physical phenomena taking place) are used to optimize screen design. Pyrotechnic signals must be transmitted only when required, and under such conditions in accordance with correctly conceived design parameters. The mechanical properties of various materials subjected to projectile impacts are listed. A system composed of three layers of different materials is proposed: a first layer resisting the penetration of the projectile and made of a very hard material (steel or alumina), a second layer dampening shock (teflon, carbon felt), and a third layer of high resistance capable of withstanding the shock induced. Author (ESA)

N80-26501# Societe Nationale des Poudres et Explosifs, Vert-Le-Petit (France).

HEXANITROSTILBENE DETONATING CORDS

L. R. Guy, J. Lecloitre, and A. Thibieroz (Soc. Natl. des Poudres et Explosifs, Sorgues, France) *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 107-111 refs (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

As HNS is less sensitive than hexogene, safety is improved. It is possible to use fuses with silver sleeves over a wide temperature range (liquid nitrogen temperature to more than 200 C). Cutting fuses were developed with capacities ranging from 1.4 to 5.6 mm of very soft steel. Very small diameter transmission fuses can be fabricated. However, the smallest diameter fuse which can be used in conjunction with a backup relay, itself charged with HNS, corresponds to a loading of 0.45g/m. A flexible sleeve which is thermo-stable and capable of withstanding the effects of detonating a 0.9g/m loaded fuse and which remains leaktight after operation is described.
Author (ESA)

N80-26502# European Space Research and Technology Center, Noordwijk (Netherlands).

LC3 APPLICATION AS A STANDARD PYROTECHNIC POWER AMPLIFIER

D. Levins, D. OSullivan, and A. Weinberg *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 113-117 refs (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

A breadboard design is presented for a new nondissipative current controller (limit Cycle Conductance Control) designed to supply a standard squib firing pulse of five amperes for a time duration of 40 milliseconds. This type of control can be provided by a low energy source with an unregulated voltage input. A standard system is thus available that can be re-used for various firings. Economic, time saving and reliability advantages are to be gained. Author (ESA)

N80-26503# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).

PYROTECHNIC LOGIC APPLICATIONS FOR ARIANE LAUNCHER

P. H. Boeglin and J. R. Fauvel *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 119-124 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The multiple pyrotechnic functions to be assured on ballistic and space missiles led to the development of pyrotechnic logic. The Ariane destruction and separation system requires a series of functions to be fulfilled: destruction of the three stages, ignition of braking and accelerating rockets, the disposal of accelerating rockets after use and the separation of 1/2 and 2/3 stages. The components used are described together with ways of improving performance. Author (ESA)

N80-26504# Centre National d'Etudes Spatiales, Toulouse (France).

NEUTRON RADIOGRAPHY APPLIED TO THE DEVELOPMENT AND QUALITY CONTROL OF ARIANE LAUNCHER'S PYROTECHNIC SYSTEMS

J. P. Boulourmie and A. Laporte (CEA, Fontenay-aux-Roses, France) *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 127-137 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The usefulness of neutron radiography as a nondestructive testing tool for examining hermetically sealed pyrotechnic and synthesis materials is briefly reviewed. The two industrial scale installations used to examine Ariane components are described. The pyrotechnic systems of the launch vehicle are presented. The specific roles of neutron radiography during the different phases in the development of these systems is then discussed together with future progress likely in this field. Author (ESA)

N80-26505# Commissariat a l'Energie Atomique, Paris (France). Centre d'Etudes.

CHARACTERIZATION AND NON-DESTRUCTIVE TESTING OF EXPLOSIVE MATERIALS BY ULTRASONIC METHODS

N. Chretien and C. Perennes *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 139-148 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The measurement unit employed is described; it consists of a repetitive ultrasonic pulse generator, a wide band receiver-amplifier system with visual display facilities and a means of synchronizing the generator and receiver. Various related topics are discussed: choice of testing frequency, choice of transmitter-receiver and required sample characteristics. The different methods employed to obtain specific information (homogeneity, cracking) are described. The application of the techniques presented enables the quality and reliability of explosive material parts to be improved. Author (ESA)

N80-26506# Societe Europeenne de Propulsion, Bordeaux (France).

THERMAL TEST FOR ELECTROPYROTECHNIC COMPONENTS. A NEW METHOD: SPECIFICATIONS AND PERFORMANCES OF THE ELECTROMAGNETIC TESTING SET

Pierre Thebault, Jean-Marie Gramond, Jean Claude Massaloux, and Jean Francois Roux *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 149-161 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The state of the filament/pyrotechnic composition interface of electropyrotechnic initiators was examined. The thermal response method involves monitoring the potential difference across the ends of the filament as it heats up. Normally the results of such tests do not provide sufficient information. A three dimensional, nonstationary model is proposed to exploit the results obtained. Two parameters appear necessary to define the real thermal response, the percentage of the filament surface in contact with the adjacent material, and the heat storage capacity of the filament during the temperature rise period. The equipment, performance, and results are presented.Author (ESA)

N80-26507# Commissariat a l'Energie Atomique, Paris (France).

ELECTROTHERMAL NON-DESTRUCTIVE TESTING FOR HOT WIRE PYROTECHNIC INITIATORS

C. Kassel and N. Chretien *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 163-169 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Cooling and heating techniques were studied. The heating technique was found to be the most sensitive. The application, theory and results obtained with this technique are presented. It is possible to detect filament welding defects, air films having thicknesses in excess of 0.05 mm, variations in the explosive packing density in contact with the wire and differences arising from grain shape variations. Author (ESA)

N80-26508# European Space Research and Technology Center, Noordwijk (Netherlands).

THE PYROTECHNIC FIRING TEST: ITS SIGNIFICANCE AND THE IMPORTANCE OF ENVIRONMENTAL CONDITIONING AND INSTRUMENTATION IN ITS SUCCESS

N. Cable *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 171-177 (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The significance of the firing test is explained with reference to the single shot nature of the pyrotechnic and the test program used to establish the system's capability. Test requirements are given together with the sequence of events culminating in firing. Test equipment falls into two categories, that needed to establish and maintain environmental conditions, and that required for the actual test. Both types of equipment are described. Realism, robustness and repeatability considerations are important. The characteristics of the instrumentation required are defined.
Author (ESA)

N80-26509# Direction des Constructions et Armes Navales, Toulon (France). Groupe d'Etude et Recherche de Pyrotechnie.
DETERMINATION OF ELECTRICAL OR ELECTROMAGNETIC SENSITIVITY IN ELECTROPYROTECHNIC INITIATORS BY STATISTICAL METHODS
R. Malabiau *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 179-200 refs In FRENCH (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

In this type of problem, the parameters of the distribution law are not known with sufficient accuracy and the variations sought are often masked by fluctuations. A comparative study is made of some applicable statistical tests (Bruceton test, one-shot test, Probits test). The effectiveness of each of these tests is established. It is shown how the various statistical parameters involved are handled. A general method combining the properties of the above tests is proposed with a higher degree of accuracy being obtained.
Author (ESA)

N80-26510# Franklin Inst., Philadelphia, Pa. Applied Physics Lab.
ELECTROSTATIC TESTING OF ELECTROEXPLOSIVE DEVICES
R. Thompson *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 201-209 (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Four commercial electrostatic testers for electroexplosive devices were analyzed by direct computer integration of the relevant transmission line equations. Results show that pin to pin electrostatic tests with these four testers can show differences of a factor of 62 in the energy deposited in the bridgewire of the electroexplosive device. Pins to case testing results showed up only minor differences in peak voltages delivered to the electroexplosive device's pins to case impedance. Author (ESA)

N80-26511# Commissariat a l'Energie Atomique, Paris (France).
EXPLOSIVE SAFETY LIMIT ESTIMATION: EVALUATION OF A SENSITIVITY LAW BY DETERMINATION OF LOW PROBABILITY REACTION LEVELS
J. Sorel, C. Kassel, and J. M. Brosse *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 211-220 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

It is shown that low probability levels can be reached in simple tests such as the drop hammer test on small pellets. The experimental equipment used is described. Up and down transformed response analysis enables pyrotechnic reaction probability levels differing from 50 percent to be approximated experimentally. This analysis was applied to impact tests on different explosive formulas. A sensitivity curve was deduced from the results. The form of the sensitivity laws governing the behavior of these explosives is deduced from this curve.
Author (ESA)

N80-26512# Direction des Constructions et Armes Navales, Toulon (France). Groupe d'Etude et Recherche de Pyrotechnie.
MEANS FOR DECREASING THE SENSITIVITY OF ELECTROPYROTECHNIC DEVICES
R. Malabiau *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 221-237 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

A survey of techniques used to reduce or eliminate interference effects of internal of external origin is presented. Suitable insulation, shielding and grounding are among the precautions to be taken. Other means include using devices with very low sensitivity to electromagnetic radiation, filtering cells and incorporating electrical relays, and isolating the electropyrotechnic device from the firing circuit. The costs, material characteristics, and methods for mounting the filters are examined, together with common mode failure problems and the behavior of filters when subjected to pulses.
Author (ESA)

N80-26513# Bundesinstitut fuer Chemisch-Technische Untersuchgen, Swisttal-Heimerzheim (West Germany).
SAFETY OF SECONDARY EXPLOSIVE FUSE TRAINS
H. Bartels *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 239-246 refs (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Design safety principles for modern fuses are interpreted and requirements for exploding bridgewire detonators are discussed. The various components are presented. The shock wave sensitivity of booster devices is checked by means of a special test. The influence of low-intensity shock waves on such explosive devices was considered for a drop test. Tests using a French exploding bridgewire detonator are described.
Author (ESA)

N80-26514# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
ESTIMATED AND EXPERIMENTAL RELIABILITY IN SPACE PYROTECHNICS
C. Lemay *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 247-251 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The specific nature of pyrotechnic materials and their conditions of use are described. And the methods and problems associated with the theoretical analysis and estimation of pyrotechnic reliability are presented. The experimental approximation of reliability by a statistical analysis of test results, and the constraints affecting the validity and implementation of sensitivity testing are discussed.
Author (ESA)

N80-26515# Centre National d'Etudes Spatiales, Toulouse (France).
EVALUATION OF A PYROTECHNIC ACTUATOR CONCEPT BY MEANS OF THE PROBIT STATISTICAL METHOD
J. Maquet and C. Tarrieu *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 253-260 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The equipment and pressure circuits involved are presented. It is shown that the experimental reliability of a pyrotechnic valve (or any other pyrotechnic device) can be determined from an aging model, the results of a certain number of ignition tests and the application of Probits method. An advantage of this procedure is that in many cases, overcharging, which is often the cause of functional problems (distortion, leakage etc.), can be prevented.
Author (ESA)

N80-26516*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLES: A PYROTECHNIC OVERVIEW
Thomas J. Graves *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 263-269 (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01 CSCL 19A

Pyrotechnic components specified in Shuttle system designs to accomplish varied tasks during all mission phases are described. The function of these pyrotechnics in the operation of the space shuttle vehicle is discussed. Designs are presented for pyrotechnics with innovative features of those meeting unique shuttle requirements for safety and reliability. A rationale for the qualification and certification of these devices is developed. Maintenance of this qualified system in production hardware is explained through a description of shuttle flight certification review process.
Author (ESA)

N80-26517# Centre National d'Etudes Spatiales, Toulouse (France).
PYROTECHNIC FUNCTIONS AND SYSTEMS OF THE ARIANE LAUNCH VEHICLE. DESIGN AND DEVELOPMENT METHODOLOGY
J. P. Boulaumie and P. Gauge (CNES, Paris) *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 271-286 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

A brief description is given of the Ariane launch vehicle together with the different associated pyrotechnic functions. The design and development of the pyrotechnic systems is examined, the methodology being based on a strictly controlled cost/effectiveness ratio. The technical criteria governing the design of the various pyrotechnic systems are presented. The control procedures applied to the development of these systems are then described. A cost breakdown is given for a standard pyrotechnic system from which future solutions are envisaged.
Author (ESA)

N80-26518# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
PYROTECHNIC DEVICES MANUFACTURED BY AVIONS MARCEL DASSAULT-BREGUET AVIATION FOR THE ARIANE LAUNCHER: THEIR CHARACTERISTICS
L. Pierron *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 287-295 (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Some special features of the pyrotechnic devices in the Ariane launch vehicle are described: the pyrotechnic system initiating the Ariane nose fairing separation device, hot wire electrical initiators of the 1 ampere/1 watt/5 minute no flame type, and ten and twenty second pyrotechnic delay devices (to be inserted in transmission systems with detonating fuses). Various components are presented together with the particular ways in which they are used.
Author (ESA)

N80-26519# Societe Nationale des Poudres et Explosifs, Vert-Le-Petit (France). Centre de Recherches du Bouchet.
DESTRUCTION CUTTER FOR THE THIRD STAGE OF THE ARIANE LAUNCH VEHICLE
L. R. Guy and J. Lecloitre *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 297-301 refs In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The destruction function of the third stage of the Ariane launch vehicle, unlike that of the first two stages, can not be achieved by standard cutting fuses because of the particular composition of the tanks in this stage. A specific dihedral charge was developed, obtained by injection, followed by in situ polymerization of a composite explosive with octogene in a light alloy case. This charge has a cutting capability sufficient to make a large cut in the tank walls, despite the large operating distance necessitated by the thickness of the thermal protection and by the layer of ice which may form on the outside of this protection. Qualification tests demonstrated the normal functioning of this cutting device under real conditions simulation of the mechanical and environmental conditions corresponding to Ariane).
Author (ESA)

N80-26520# Nobel's Explosives Co. Ltd., Stevenston (England).
THE MEASUREMENT AND PREDICTION OF OUTPUT CHARACTERISTICS OF MINIATURE PYROTECHNIC ACTUATORS
R. Woomble and L. E. Medlock *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 303-312 (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The measurement of output characteristics of pyrotechnic actuators is described. The characteristics studied include operating time, stroke, energy of work output, thrust-time profile and stroke-time relationship of the actuators. The static pressure-time characteristics of the gas producing compositions used in the actuators were also studied. By choice of the type and quantity of gas producing charge, the design can be optimized for operation against a given load and the effect of stand-off of the actuator from the mechanism to be operated can be measured. The thrust-time profile was recorded for actuators of the dimple, piston and bellows type and the effect of a number of variables including, charge weight, stroke length and load, were quantified.
Author (ESA)

N80-26521# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
PYROTECHNIC APPLICATIONS IN AERONAUTICS
S. Morlon *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 313-317 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

Progress made in recent years to in-flight safety (military fighting aircraft and prototype civil aircraft) and to ground safety of crashed transport aircraft (emergency exits) is reviewed. The pyrotechnic systems employed depend on the functions desired (e.g., in-flight ejection, ground separation, etc.). The materials used are described.
Author (ESA)

N80-26522# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
CREW RESCUE SYSTEM ON FALCON 50 AIRCRAFT PROTOTYPE
G. Dupin *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 319-324 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The life preservation installation for the two pilots fitted in the prototype Falcon 50 aircraft is described. The specifications of the system are given together with the ejection method used. A description of the sequences necessary to carry out the various operations is presented. Finally, the pyrotechnic circuit used to perform these sequences is briefly described, together with the sequence chronology.
Author (ESA)

N80-26523# Societe Nationale des Poudres et Explosifs, Paris (France).
PYROTECHNIC APPLICATIONS IN MARINE TECHNOLOGY
H. Frier *In* ESA Explosives and Pyrotech.: Space Appl. Jan. 1980 p 327-331 In FRENCH; ENGLISH summary (For primary document see N80-26488 17-28)
Avail: NTIS HC A16/MF A01

The history of pyrotechnic applications to marine technology is briefly reviewed. The various applications include underwater cutting systems, gas generators and syntactic foam (buoyancy applications), explosive welding, underwater propulsion devices, small generators for torpedos and underwater vehicles, and pyrotechnic starters for large marine diesel engines. Descriptions are given of the specifications and characteristics of the different equipment developed.
Author (ESA)

N80-26524# Germantown Labs., Inc., Philadelphia, Pa.
INVESTIGATION OF FUELS CONTAINING COAL-OIL-WATER EMULSIONS Quarterly Report, 1 Oct. - 1 Dec. 1978
Norman H. Cherry and Charles S. Stokes Jan. 1979 16 p
(Contract EF-77-C-01-2689)
(FE-2689-5; QR-5) Avail: NTIS HC A02/MF A01

A total of five emulsifiers were assessed for the production of stable coal-oil-water emulsions and the determination of the practibility of their use in a boiler system was being investigated. Ancillary equipment was set up and experiments completed on two units. Mounting fixtures designed and fabricated for the third and fourth units. The third unit was evaluated using 45% coal, 50% number 6 Gulf oil and 5% water. The stability of the emulsions was evaluated on the K-scan unit.
DOE

N80-26525# Rockwell International Corp., Canoga Park, Calif. Environmental and Energy Systems Div.
DEVELOPMENT OF A SINGLE-STAGE, ENTRAINED-FLOW, SHORT-RESIDENCE-TIME HYDROGASIFIER Final Report
Jul. 1979 503 p refs
(Contract EF-77-C-01-2518)
(FE-2518-24) Avail: NTIS HC A22/MF A01

A single-storage, entrained flow, short residence time reactor for flash hydrogasification of coal was developed. The unique

feature was the application of rocket engine injection/mixing techniques to the rapid mixing and reaction of hot hydrogen (approximately 2000 F) and pulverized coal in very high throughput reactors. Experiments were conducted in three different hydrogasifier reactor systems. The first was a bench scale apparatus with coal feed rates of 2 to 4 lbm/hr. Results are reported for a subbituminous coal where overall carbon conversion varied between 21 and 55% and were comparable with conversions of lignite. Engineering scale tests were conducted in the other two reactor systems at a nominal coal feed rate of 1/4 ton/hour. Results with subbituminous coal compared well with those from the bench scale reactors. DOE

N80-26526# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. Development Div.
DYNAMIC MECHANICAL ANALYSIS OF LX-13, AN EXTRUDABLE EXPLOSIVE
Gary L. Flowers Jan. 1980 34 p
(Contract EY-76-C-04-0487)
(MHSMP-80-04) Avail: NTIS HC A03/MF A01

Rheometrics mechanical spectrometers was used characterize LX-13, an extrudable explosive comprised of Sylgard 182 and PETN. Characterization included evaluating four lots of LX-13 of various extrudability and determining isothermal curing properties as functions of time. The dynamic shear storage and loss moduli as functions of temperature were also determined for cured samples. LX-13 require a long time period to completely cure, approximately 125 C and the crystalline melting temperature was found to be -40 C, the same as the binder, polydimethlysiloxane. DOE

N80-26527# Sandia Labs., Albuquerque, N. Mex. Initiating and Pyrotechnic Components Div.
COMPACTION BEHAVIOR OF TEN PYROTECHNIC MATERIALS
Olden L. Burchett, Russell W. Dietsel, and Arsenio P. Montoya Jan. 1980 16 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1833) Avail: NTIS HC A02/MF A01

The compaction behavior of KClO4, Ti/KCL O4 (33/67), TiH(065)/KClO4 (33/67), TiH(1 68)/KClO4 (33/67), HNAB, CP, b/CaCrO4 (20/80), Pd/Al (94/6), Pd/Si(90/10), and Pd/Al(80/20), was determined by using a simple compaction test and a two-step iterative procedure to fit an assumed three parameter pressure-density relationship to the test results. DOE

N80-26528# Catalytic, Inc., Wilsonville, Ala.
SOLVENT REFINED COAL (SRC) PROCESS OPERATION OF SOLVENT REFINED COAL PILOT PLANT, WILSONVILLE, ALABAMA Annual Report, Jan. - Dec. 1978
H. E. Lewis, W. H. Weber, G. B. Usnick, W. R. Hollenack, H. O. Blair, and R. G. Boykin Oct. 1979 227 p refs Prepared in cooperation with Southern Serv., Inc., Birmingham, Ala.
(Contract EX-76-C-01-2270)
(FE-2270-46) Avail: NTIS HC A11/MF A01

Operating conditions and test results obtained at six ton per day solvent refined coal (SRC) pilot plant are summarized. Two coals were processed and the effects of process variables on SRC yield and solvent quality were investigated. These variables included space rate, coal mineral concentration in the dissolver, hydrogen partial pressure, and temperature. A system for continuously withdrawing a portion of the dissolver contents was operated to investigate the effects of minimizing the concentration of solids in the dissolver. Tests confirming the high rate of coal conversion at short residence time were completed. Several methods of deashing the low pressure reaction product were tested: pressure leaf filtration; centrifugation with antisolvent addition; and 10 mm hydroclones with antisolvent addition. Both horizontal and vertical pressure leaf filtration units were tested. Filter aids such as perlite, fly ash, and several grades of diatomite were used. Operating without precoat was also studied. DOE

N80-26529# Catalytic, Inc., Philadelphia, Pa.
PRELIMINARY ENGINEERING EVALUATION OF PROMISING COAL LIQUEFACTION CONCEPTS Final Report, Dec. 1979
D. Agarwal, J. J. Cicalese, J. H. Harkins, M. T. McShance, D. J. Oriolo, and J. R. Polek Dec. 1979 201 p refs
(EPRI Proj. B32-2)
(EPRI-AF-884) Avail: NTIS HC A10/MF A01

Cost liquefaction concepts were evaluated. Ten thousand tons of coal per day were processed in the liquefaction section. Emphasis was placed on producing clean burning solid and liquid fuels suitable for electric power generation. Flash hydrogenation, supercritical gas extraction, conventional solvent refined coal (with filtration of ash), two stage solvent refined coal, conventional solvent refined coal (with critical solvent deashing), and short contact time solvent refined coal (with critical solvent deashing and hydrotreating) were investigated. For the liquefaction sections, detailed material balances, process flow diagrams, equipment sections, detailed material balances, process flow diagrams, equipment specifications, utility requirements and estimated costs were developed. For areas ancillary to the liquefaction sections, terminal material balances, overall utility requirements, and estimated costs were calculated. The conventional SRC design produced the highest thermal efficiency and product heating value, primarily due to the higher recovery of SRC when using filtration as compared to critical solvent deashing for ash removal. DOE

N80-26530# Fluor Engineers and Constructors, Inc., Irvine, Calif.
ENGINEERING EVALUATION OF CONCEPTUAL COAL CONVERSION PLANT USING THE H-COAL LIQUEFACTION PROCESS Final Report, Dec. 1979
P. A. Buckingham, R. Ravikumar, and A. A. Leavitt Dec. 1979 199 p refs
(EPRI Proj. 411-4)
(EPRI-AF-1297) Avail: NTIS HC A09/MF A01

The objective was to develop the capital costs and the product costs for and H-Coal liquefaction facility were developed. A key part of this effort was the development of a processing configuration in order to provide self sufficient facilities with respect to hydrogen, fuel, electric power, and all other utility services. The overall facility consists of a coal liquefaction plant along with the required support, utility and offsite facilities to comprise a self-sufficient operation. The major processing sections included coal preparation, coal liquefaction and product separation, light ends processing, hydrogen plant, oxygen plant, emission control systems, effluent control systems, product storage and shipping, utility systems and offsites. Capital costs upon a mid 1979 basis are $1.146 billion and $1.315 billion. The primary products naphtha, turbine oil, and distillate fuel oil are desulfurized to very low levels. The oxygen content of all three products is very high, while the nitrogen content of the turbine oil and the distillate fuel oil exceeds usual levels for conventional petroleum stocks. DOE

N80-26531# Forskningsinstitutet for Atomfysik, Stockholm (Sweden).
DEMONSTRATION PLANT FOR METHANOL PRODUCTION FROM DOMESTIC RAW MATERIALS
1979 93 p In SWEDISH
(NE-1979-5) Avail: NTIS (US sales only) HC A05/MF A01; DOE Depository Libraries

The techniques, markets and possible localization for a demonstration plant for methanol production from peat and biomass are reviewed. High temperature Winkler or Shell-Koppers gasification processes are preferred. Results indicate that the demonstration plant should have a capacity of 20 kton methanol/year and the investment cost is estimated to about 95 Mskr. DOE

N80-26532# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
DESIGN, FABRICATION AND OPERATION OF A BIOMASS FERMENTATION FACILITY
Daniel J. O'Neil, Alton R. Colcord, Mahendra K. Bery, Ronnie S. Roberts, Dalip K. Sondhi, Bryan C. Robb, Ronald R. Williams, Alfred A. Cook, J. J. Nachowiak, and J. D. Crider Aug. 1979 50 p refs Prepared in cooperation with Sverdrup and Parcel, Inc., St. Louis
(Contract ET-78-C-01-3060)
(DSE-3060-T3) Avail: NTIS HC A02/MF A01

Process economics and optimization for hexose production from wood by dilute acid hydrolysis were investigated. Application to a plug flow reactor (PFR) and to a fixed bed reactor (FBR)

were undertaken. The results indicate that the FBR is at least comparable to a PFR in terms of process economics. DOE

N80-26533# Midwest Research Inst., Kansas City, Mo.
CONTINUATION OF SYSTEMS STUDY OF FUELS FROM GRASSES AND GRAINS, PHASE 2 AND PHASE 3 Final Report
A. D. McElroy, Cynthia Tinberg, Michael Davis, Michael Snyder, and A. D. Allen 31 Jul. 1979 195 p refs
(Contract EG-77-C-01-4042)
(DSE-4042-T2) Avail: NTIS HC A09/MF A01

Biomass-derived fuels from grasses and grains are studied. A region-by-region analysis of biomass production, considering both the present (near term) and the furture (mid term) is presented. The near term analyses involved least cost estimate of production, transportation, and energy conversion. The mid term analyses involved modified crop production systems, improved crop management, and crop mixes. Conversion plants ranged in size from 500 oven dry tons per day to 3000 oven dry tons per day, or an energy input of 75 x 10 to the 9th power Btu to 45 x 10 to the 9th power Btu 7500 Btu per pound. The conversion processes consisted of anaerobic digestion, fermentation, direct combustion, and thermochemical conversion. Ammonia and methanol production was accomplished by using thermochemical conversion. DOE

N80-26534# SRI International Corp., Menlo Park, Calif.
HOMOGENEOUS CATALYTIC HYDROCRACKING PROCESSES FOR CONVERSION OF COAL TO LIQUID FUELS: BASIC AND EXPLORATORY RESEARCH Quarterly Report, 16 Sep. - 15 Dec. 1979
1979 15 p refs
(Contract EF-76-C-01-2202)
(FE-2202-51) Avail: NTIS HC A02/MF A01

The major chemical features of the catalytic activity in our CO-blue water system was determined and a preliminary investigation of its potential for coal upgrading was conducted. The nature of blue water catalysis and test its effectiveness with CO and H2 was studied. Catalyst candidates of selected transition metal salts were similarly tested. We have determined that blue water catalysis is not due to coal-derived components, and we have ruled out any major involvement of formate. It is shown that the activity of blue water is due to transition metals content. Also blue water catalysts is less effective in the pressure of H2 than CO. DOE

N80-26535# SRI International Corp., Menlo Park, Calif.
PREPARATION OF A COST DATA BANK FOR DOE/BIOMASS ENERGY SYSTEMS BRANCH Quarterly Progress Report, 1 Jul. - 30 Sep. 1979
Anthony Y. Kam, Ronald L. Dickenson, Jerry L. Jones, David C. Bomberger, Anil K. Chatterjee, Wing S. Fong, Paul C. Meagher, and Donald J. Wilhelm 1979 82 p refs
(Contract EY-76-C-03-0115-141; Contract DE-AT03-76ET-20605)
(DOE/ET-20605/4; QPR-4) Avail: NTIS HC A05/MF A01

Technical and economic analyses of Biomass Energy Systems (BES) technology options are reviewed. A total of 22 biomass conversion technology options (14 thermochemical and 8 biochemical) were selected for inclusion in the data bank. These options cover the production of electric power, steam, gases, liquids, and solid fuels from biomass. A consistent methodology for construction of the data bank was developed. For each option, the process/product data were gathered and analyzed. A base case was established to generate estimates for plant investments required, operating cost, and product cost. Statistical methods to produce error band estimates are used. Preliminary results for catalytic liquefaction (PETC and LBL processes), gasoline from biomass (China Lake process), and MBG from wood, ethanol fermentation are reported. A sensitivity analysis for cogeneration is also reported. DOE

N80-26536# International Nickel Co., Inc., Suffern, N. Y.
MICROSTRUCTURE AND HYDRIDING STUDIES OF AB5 HYDROGEN STORAGE COMPOUNDS Final Report
P. D. Goodell, G. D. Sandrock, and E. L. Huston Jan. 1980 176 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7095) Avail: NTIS HC A09/MF A01

Data on the microstructure, pressure-composition-temperature, and absorption/desorption kinetics of AB sub 5 metal hydrides are presented. The most significant result to emerge from the investigation is that many of the AB sub 5 metal hydrides, especially the LaNi5 related materials, show instantaneous absorption and desorption response in proportion to the amount of cooling or heating or heating which is provided. DOE

N80-26537# California Univ., Livermore. Lawrence Livermore Lab.
LLL DATA ACQUISITION SYSTEM FOR LIQUEFIED GASEOUS FUELS PROGRAM
John Baker 17 Mar. 1980 15 p
(Contract W-7405-eng-48)
(UCID-18576) Avail: NTIS HC A02/MF A01

The liquefied natural gas dispersion tests were examined. The system employed 51 battery powered complementary metal oxide semiconductor (CMOS) data acquistion units to measure gas concentration, wind direction and speed, temperature, humidity, and heat flux. Data acquired by the CMOS data acquisition units were telemetered via UHF radio links to a trailer based microcomputer command, control, and data recording system (CCDRS). In the CCDRS wind data were displated graphically. DOE

N80-26538# Los Alamos Scientific Lab., N. Mex.
UTILIZATION OF SOLAR THERMAL SOURCES FOR THERMOCHEMICAL HYDROGEN PRODUCTION
Melvin G. Bowman 1980 6 p refs Presented at the Am. Sect. of the Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2-6 Jun. 1980 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-80-837; CONF-800604-3) Avail: NTIS HC A02/MF A01

The utilization of high temperature solar heat for the production of electricity and/or fuels is considered. Solar concentrator systems are discussed in terms of cost and practicality. Conversion efficiency and energy storage requirements are also considered. DOE

N80-26539# Brookhaven National Lab., Upton, N. Y.
HEAT TRANSFER ENHANCEMENT IN METAL HYDRIDE SYSTEMS
M. J. Rosso, Jr. and G. Strickland Dec. 1979 8 p refs Presented at the 2nd Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10 Dec. 1979
(Contract EY-76-C-02-0016)
(BNL-27347; CONF-791204-27) Avail: NTIS HC A02/MF A01

The Brookhaven National Laboratory, Department of Energy and Environment has been engaged in finding solutions to the engineering problems associated with the storage of hydrogen as metal hydrides - principally iron-titanium hydride. The thermal conductivity in beds of fine particles, whatever their composition, is inherently poor. Attempts to enhance the heat transfer by the addition of small fractions of high conductivity materials in various configurations are described. The results indicate that the form of the enhancement material rather than its composition is the more critical factor. DOE

N80-26540# Oak Ridge National Lab., Tenn.
BIOLOGICALLY IMPORTANT COMPOUNDS IN SYNFUELS PROCESSES
B. R. Clark 1980 26 p refs Presented at the 179th Meeting of the Am. Chem. Soc., Symp. on Environ. Control in Synfuels Processes, Houston, Tex., 25 Mar. 1980
(Contract W-7405-eng-26)
(CONF-800303-13) Avail: NTIS HC A03/MF A01

Biologically active constituents were isolated in preparative scale amounts from complex mixtures utilizing combinations of liquid-liquid extraction and various liquid chromatographic column-eluant combinations. Fractions were characterized using a combination of spectroscopic techniques and gas chromatography/mass spectrometry. DOE

N80-26541# Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V., Hamburg (West Germany).

INVESTIGATION OF THE BEHAVIOR OF MENTHANOL AS AN ENGINE FUEL
1979 111 p refs In GERMAN
(NP-24342; RR-45151) Avail: NTIS (US Sales Only) HC A06/MF A01; DOE Depository Libraries

The use of methanol as a substitute fuel and as a mixing component for the dilution of Otto engine fuels was investigated. The results indicate that if methanol is to be used for the operation of Otto engines, vehicles must be adapted, and the supply system must be modified. For methanol/fuel mixtures, solutions to the important problem of demixing must be found. DOE

N80-26542# Kernforschungsanlage, Juelich (West Germany).
CALCULATIONS AND ANALYSIS OF STEAM METHANE REFORMING USING HIGH TEMPERATURE REACTOR HEAT
H. Neis Jul. 1979 155 p refs In GERMAN
(Juel-Spez-48) Avail: NTIS (US Sales Only) HC A08/MF A01; DOE Depository Libraries

The application of nuclear process heat for steam methane reforming as a modification of conventional technology was studied. A computer program was developed which allows the calculation of heat transfer to an extend heated tubular reactor in which the catalytic reactor takes place. Calculations for comparison with experimental data are in satisfactory agreement. A sensitivity analysis shows the influence of single model parameters on the computational results. From parametric studies design data for steam reformers were obtained which may serve as basis for project work of a process heat plant. DOE

N80-26543# Occidental Research Corp., Irvine, Calif.
FLASH PYROLYSIS COAL LIQUEFACTION PROCESS DEVELOPMENT Final Report, Jul. 1978 - Jun. 1978
Stanley C. Che, Kandaswamy Duraiswamy, Everett W. Knell, and Chang-Kuei Lee Apr. 1979 184 p refs
(Contract EX-76-C-01-2244)
(FE-2244-26) Avail: NTIS HC A09/MF A01

A specially designed, proprietary, caking coal reactor was demonstrated to process caking coals without oxidative pretreatment. Tar yields of about 35 wt % mixed amine fuel (MAF) were achieved in a 3 ton per day process development unit (PDU) from Western Kentucky No. 9 seam bituminous coal, and tar yields of about 22 wt % MAF were achieved from Wyoming Monarch seam subbituminous coal at a reactor residence time of about 1.5 seconds and a temperature of about 1200 F. The hydrorefining processability of the pyrolysis tar was demonstrated using a continuous hydrotreater. Two major technical problems were encountered and solved: (1) the initial PDU tar yield results were low compared to projections from the bench scale reactor; and (2) poor char rate control severely limited the PDU reactor operability. DOE

N80-26544# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PROCESS DEVELOPMENT STUDIES ON THE BIOCONVERSION OF CELLULOSE AND PRODUCTION OF ETHANOL
Charles R. Wilke and Harvey W. Blanch Dec. 1979 41 p refs
(Contract W-7405-eng-48)
(LBL-10373) Avail: NTIS HC A03/MF A01

Fermentation operations were conducted in S-liter New Brunswick fermentors. The medium was used for all experiments. Ball-milled solka floc (BW 200) and Tween 80 at 1.0% and 0.02% concentration, respectively, was used for all runs. Four day old, 10% mycelium inoculum was used for all fermentation. The pH was adjusted with 2N NaOH, and 2N H2SO4. The effect of operating conditions on state variables was demonstrated. Results indicate that controlling the temperature of 28 C throughout the fermentation decreases the Beta glucosidase activity and soluble protein, while C sub 1, C sub x, and EPA activities remain the same. The higher level of beta glucosidase permits more rapid conversion of cellobiose to glucose. This then relieves the cellobiose inhibition of the C sub 1 enzyme and hence increases the rate of depolymerization of crystalline cellulose. R.C.T.

N80-26545# Gulf Research and Development Co., Pittsburgh, Pa.
RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE MOTOR FUELS Annual Report, Jun. 1978 - May 1979
D. C. Succop and F. E. Wynne Jul. 1979 120 p
(Contract EX-76-C-01-1800)
(FE-1800-39-Vol-1) Avail: NTIS HC A06/MF A01

Urgently needed design criteria for hydroliquefaction slurry heating were developed. It is shown that data needed on heat transfer coefficients, tube wall temperatures, slurry viscosities, slurry residence times and solvent characteristics. It is also shown that reactions occur within the slurry heaters but the extent of these reactions and the effect of heater design on the reactions is not clearly defined in terms of heat requirements, physical property changes and the effect of heater design on subsequent reaction in the downstream reactors and their design. Also, heater operating limits related to fouling are needed and fouling tests conducted with coal/petroleum resid slurries indicated that these limiting factors could be examined by similar tests. DOE

N80-26546# Gulf Research and Development Co., Pittsburgh, Pa.
RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE MOTOR FUELS
D. C. Succop and F. E. Wynne Jul. 1979 298 p Annual Report, Jun. 1978 - May 1979
(Contract EX-76-C-01-1800)
(FE-1800-39-Vol-2) Avail: NTIS HC A13/MF A01

Data are presented characterizing the operating conditions as well as the product yield for the process of converting coal to synthetic gasoline and other distillate motor fuels. Yields of distillate and residue were obtained by gas chromatography of the heater total liquid product. Hydrocarbon type analysis for the total liquid product was obtained by liquid chromatography and is reported under recovered heavy distillate. A common elemental analysis of the total liquid product is shown as product liquid fractions. Products were vacuum distilled and boiling ranges of the cuts were corrected to obtain optimum yields. R.C.T.

N80-26547# Teledyne CAE, Toledo, Ohio.
GAS TURBINE DEMONSTRATION OF PYROLYSIS-DERIVED FUELS Technical Progress Report, 1 Sep. 1978 - 31 Mar. 1979
G. Jasas 1979 34 p refs
(Contract ET-78-C-03-1839)
(SAN-1839-T1; TPR-1) Avail: NTIS HC A03/MF A01

A potential nonpetroleum base alternate fuel for gas turbines was identified. This fuel was derived from agricultural and forestry products/wastes through a pyrolysis conversion. Three combustible products were produced: a heavy oil; residual char; and gas. Blending of the char and oil products yielded a two phase (slurry) fuel with a heating value that was approximately 85 percent (volumetric) of typical petroleum base fuels. R.C.T.

N80-26548# Propellants, Explosives and Rocket Motor Establishment, Waltham Abbey (England).
INITIATION OF AERATED NITROGLYCERINE IN AN EDUCTOR
D. G. Tasker London HMSO Oct. 1979 15 p refs
(PERME-TR-120; BR70957) Avail: NTIS HC A02/MF A01

A technique is described for the measurement of the shock wave pressures generated within nitroglycerine (NG), when the liquid surface strikes a steel cylinder. These pressures have been observed in a model of a Biazzi Nitroglycerine Eductor; they are shown to be in close agreement with those theoretically predicted and indicate that this mechanism for the initiation of explosion in NG requires serious consideration. Author (ESA)

N80-26549# Chemical Engineering Research Group, Pretoria (South Africa).
HYDRODENITROGENATION OF COAL LIQUIDS AND PETROLEUM WITH HETEROGENOUS CATALYSTS IN MULTIPHASE REACTORS. REVIEW AND RECOMMENDATIONS FOR FURTHER WORK
C. M. Stander Nov. 1979 35 p refs
(PB80-151442; CSIR-CENG-298; ISBN-0-7988-1721-6) Avail: NTIS HC A03/MF A01 CSCL 21D

Absorption and catalytic hydrodenitrogenation in three stage reactors are considered for the removal of nitriles and heterocyclics from coal liquids. The intraparticle rate controlling processes were studied by determining effective diffusivities using model liquids and the interparticle rate controlling processes were evaluated by studying the hydrodynamics of coal liquids in trickle-bed reactors. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-26550# Department of Energy, Washington, D. C. Federal Energy Management Program.
ARCHITECTS AND ENGINEERS GUIDE TO ENERGY CONSERVATION IN EXISTING BUILDINGS
1 Feb. 1980 468 p
(DOE/CS-0132) Avail: NTIS HC A20/MF A01

A field-tested approach to identifying, analyzing, and recommending action on the wide range of opportunities and options available to reduce energy use in most existing buildings is offered. Besides a review of the principles of energy use and conservation, the manual provides a step-by-step methodology for assessing and improving the year-round energy performance of buildings, as well as a series of forms, charts, and nomographs designed to enhance and simplify the work of those architects and engineers whose practice includes the analysis and modification of existing buildings to reduce both fuel consumption and operating costs. A.R.H.

N80-26551# Physics Lab. RVO-TNO, The Hague (Netherlands). Research Group Microwaves.
[ON MICROWAVE MEASUREMENT, TRANSMISSION AND RECEPTION]
J. Sneider, ed. Dec. 1978 138 p refs
(PhL-1978-54) Avail: NTIS HC A07/MF A01

Thirteen papers dealing with microwave measurement, transmission, and reception are presented. Subjects covered include sea-clutter and target signatures, planar as well as linear phased array antennas, diode and ferrite phase shifters, and rain attenuation of microwaves shown by 95 GHz propagation measurements. Noteworthy results relate to the effect on transmitted power of placing a sheet with a low dielectric constant in front of a planar phased array antenna. Also, a comparison of statistical distribution methods points out the usefulness of a scattering theory in the analysis of microwave propagation data. For individual titles, see N80-26552 through N80-26564.

N80-26552# Physics Lab. RVO-TNO, The Hague (Netherlands).
CHARACTERISTICS OF CLUTTER AND TARGETS AT X- AND Ku-BANDS c32
H. Sittrop *In its* On Microwave Meas., Transmission and Reception Dec. 1978 28 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

The radar backscatter of the sea per unit area and the rms clutter velocity spread versus grazing angle and wind velocity are described by an experimental model. The obtained results justify the assumption that the model can be used in the near grazing and in the plateau regions. The two scatter mechanisms of Bragg resonant capillary waves and small facet overlayer the shorter gravity waves are discussed. Characteristic ratios of sea per unit area are presented versus velocity. Next, a multipath radar cross section approximation for a variety of target models and clusters is given numerically in a closed form. Optimum signal to clutter ratios are discussed for the detection of buoys by shipping traffic. Characteristics of arbitrarily chosen target clusters are simulated and typical discrepancies between clutter and target scintillations are demonstrated. The influence of precession, nutation, and rotation on radar backscatter, due to irregularities of a body of revolution, is shown. Clutter and target model applications in finding an optium combination of relevant and environmental parameters are discussed. Author (ESA)

N80-26553# Physics Lab. RVO-TNO, The Hague (Netherlands).
SEA-CLUTTER DEPENDENCY ON WINDSPEED c32
H. Sittrop *In its* On Microwave Meas., Transmission and Reception Dec. 1978 4 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

The capillary wave effect on radar sea-clutter is discussed. The interaction between wind speed and these capillary waves is shown to be instantaneous and hence, is a first order effect which has an impact on various clutter characteristics. Computations to determine the average radar cross sections per unit area and the rms clutter velocity spread, both from experimentally derived constants, indicate that clutter cell size seems to significantly influence the statistical behavior of sea-clutter at horizontal polarization and is thus of vital importance in finding threshold levels for target detection. Author (ESA)

N80-26554# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE DESIGN CONSTRUCTION AND TEST RESULTS OF THE CAISSA PLANAR SPACE FED PHASED ARRAY ANTENNA c32
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 13 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

The design, construction, and test results of the CAISSA antenna with 850 radiating elements are given. The elements are open-ended rectangular waveguides placed in a triangular grid. The antenna was tested from 5.4 to 5.9 GHz to a maximum scan angle of 60 deg. A multimode feed horn was used. The production results of the phase shifters and methods of how to reduce the spread in insertion phase are mentioned. The influence of the rms error on the sidelobe level is discussed. A special far field measuring method for quickly measuring antenna radiation patterns was used. Experimental results are given regarding beamwidth, gain, sidelobe level, and monpoulse as a function of scan angle frequency. The degradation of a phased array antenna due to random failing of elements is also discussed. Author (ESA)

N80-26555# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE PERFORMANCE OF AN IRIS-LOADED PLANAR PHASED-ARRAY ANTENNA OF RECTANGULAR WAVE-GUIDES WITH AN EXTERNAL DIELECTRIC SHEET c32
H. J. vanSchaik *In its* On Microwave Meas., Transmission and Reception Dec. 1978 8 p refs Repr. from IEEE Trans. on Antennas and Propagation, v. AP-26, no. 3 May 1978 8 p (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

A method for calculating the performance of an iris-loaded planar phased-array antenna of rectangular waveguides is presented. The method is based upon the expansion of the tangential electric aperture field in terms of judiciously chosen functions. Also, the influence of a dielectric sheet in front of an antenna, the apertures of which are loaded with inductive irises, is investigated. In the experiments, a sheet with a low relative permittivity is placed in front of a space-fed planar antenna of some 850 radiating elements; the total transmitted power of the antenna is measured as a function of frequency and scan angle. The results indicate that both in theory and in practice an excellent match can be achieved with a polythene sheet or a Perspex sheet. Author (ESA)

N80-26556# Physics Lab. RVO-TNO, The Hague (Netherlands).
THEORETICAL AND EXPERIMENTAL RESULTS OF AN IRIS-LOADED PLACAR PHASED-ARRAY ANTENNA WITH AN EXTERNAL DIELECTRIC SHEET c32
H. J. vanSchaik *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

The influence of a dielectric sheet on the performance of an iris-loaded, planar, phased-array antenna of rectangular waveguides was investigated both theoretically and experimentally. Particularly, the influence of a sheet with a low dielectric constant is shown. In practice, the influence of the matching structure on the transmitted power of a planar, space-fed array of some 850 radiating elements was determined as a function of frequency. It is found that a simple polythene/perspex sheet improves wide

angel scan considerably over the frequency band from 5.4 to 5.9 GHZ. Author (ESA)

N80-26557# Physics Lab. RVO-TNO, The Hague (Netherlands).
NUMERICAL AND EXPERIMENTAL ANTENNA PATTERNS OF A SPACE-FED PLANAR PHASED-ARRAY ANTENNA c32

H. J. vanSchaik *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

The illumination function and the far field radiation pattern of the space-fed antenna is considered. Numerical and experimental results, related to the performance of a planar, space-fed, phased array antenna of circular cross section, operating in the C-band (5.4 to 5.9 GHz) with some 850 radiating elements and 325 dummy elements (placed at the rim of the antenna), are presented. This antenna is referred to as the CAISSA antenna. A method to deal with the differences in phase correction pertaining to the different elements of the antenna and which originates from the free-space propagation of the wave emitted by the feeding horn is given. Further, the influence of the failure of a certain percentage of the phase shifters on the antenna pattern of the CAISSA antenna is illustrated experimentally. Author (ESA)

N80-26558# Physics Lab. RVO-TNO, The Hague (Netherlands).
A SIMPLE AND FAST MATCHING METHOD FOR MUTUAL COUPLING OF A LINEAR PHASED ARRAY ANTENNA WITH WAVEGUIDE APERTURES AS RADIATING ELEMENTS c32

J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

Loss due to mutual coupling in a phased array antenna is considered. As an example, a linear array of open-ended rectangular waveguides was used. Coupling coefficients were measured. With these coefficients it was possible to calculate mutual coupling as a function of scan angle and frequency. Using internal matching structures, the performance of the linear array was then improved. Results show that simply matching the array elements of a linear array in their natural surroundings to free space at the center frequency gives almost optimum compensation for mutual coupling over the scan interval. Author (ESA)

N80-26559# Physics Lab. RVO-TNO, The Hague (Netherlands).
A SURVEY OF PROPERTIES OF LATCHED NON RECIPROCAL FERRITE PHASE SHIFTERS WITH CYLINDRICAL RODS AT 3, 5.5, 9.3 AND 16 GHz c33

J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

Experimental results of non reciprocal latched ferrite phase shifters are given in the frequency bands S, C, X, and Ku. The flux drive principle is used for the driver. The shape of the ferrite is for all examined cases a cylinder with an axial conentric hole for the switching wire of the driver. Two narrow flat strips are ground on the cylinder in order to achieve good contact with both broad walls of the rectangular waveguide in which the ferrite toroid is placed. The width of the waveguide over the length of the toroid is adjusted in such a way that the differential phase shift is independent of frequency over a bandwidth of at least 20%. In general, this width is smaller than the standard waveguide width. The height of this waveguide part is identical to the height between the two narrow flat strips and therefore just a little smaller than the diameter of the toroid. With the aid of matching transformers and waveguide tapers, the cross section of the ferrite loaded waveguide is brought to that of the standard waveguide. With this setup, the phase shift, the insertion loss, the temperature dependence of the phase shift, and the peak power capability of the phase shifter are measured. Various types of ferrite are examined, such as magnesium-manganese ferrite, lithium ferrite, and mixed garnets. The saturation magnetization value is selected in such a way that low-field losses are avoided. Author (ESA)

N80-26560# Physics Lab. RVO-TNO, The Hague (Netherlands).
PERFORMANCE OF FERRITE AND DIODE PHASE SHIFTERS AT MILLIMETER WAVELENGTHS c33

J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 21 p (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

The performance possibilities at millimeter wavelengths of the nonreciprocal latched ferrite phase shifter, the reciprocal dual mode latched ferrite phase shifter, the diode phase shifter, and the Reggia-Spencer type of reciprocal ferrite phase shifter are discussed. An indication is given as to the availability of suitable ferrites for these high frequencies. Use is made of available information on lower frequencies for extrapolation to higher frequencies. Various types of ferrite, such as magnesium-manganese ferrite, lithium ferrite, and mixed garnets, are examined. Characteristics considered include differential phase shift and insertion loss, peak power capability, and temperature dependence. The several phase shifters are then ranked according to an arbitary figure of merit. Author (ESA)

N80-26561# Physics Lab. RVO-TNO, The Hague (Netherlands).
MICROSTRIP DIODE PHASE SHIFTERS FOR S-BAND AND C-BAND c33

W. P. M. N. Keizer *In its* On Microwave Meas., Transmission and Reception Dec. 1978 8 p (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

Two 4 bit PIN diode phase shifters operating at S band and C band are described. Both devices, constructed in microstrip on 0.635 mm thick alumina dielectric, consist of 22.5 deg and 45 deg loaded line configurations and of 90 deg and 180 deg rat-race hybrid coupled sections. Details of the design of the single bits, carried out with computer aided design techniques, are presented. Measured results are included. They indicate for the S band phase shifter (2.85 to 3.15 GHz) + or - 4 deg phase shift accuracy, 1.7 dB average insertion loss, and 1.4 maximum VSWR; for the C band phase shifter (5.4 to 6.0 GHz) there is + or - 0.7 deg phase shift accuracy, 1.3 dB average insertion loss, and 1.5 maximum VSWR. Author (ESA)

N80-26562# Physics Lab. RVO-TNO, The Hague (Netherlands).
COMPARISON BETWEEN FERRITE AND DIODE PHASE SHIFTERS TO BE USED IN PHASED-ARRAY ANTENNAS c33

J. Sneider and W. P. M. N. Keizer *In its* On Microwave Meas., Transmission and Reception Dec. 1978 9 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

A survey is given of the properties of the nonreciprocal latched remanent ferrite phase shifter and of the diode phase shifter in microstrip. A comparison is made between these two types at 3 GHz where items which are important for use in phased array antennas are used as a yardstick. The deviating results at lower and higher frequencies are mentioned separately. Other types of ferrite and diode phase shifters are also discussed. The possibilities of realizing phase shifters at millimeter wavelengths are mentioned. An indication of very recent and expected future trends is given. Some remarks on cost are made. Author (ESA)

N80-26563# Physics Lab. RVO-TNO, The Hague (Netherlands).
RAIN ATTENUATION MEASUREMENTS AT 94 GHz: COMPARISON OF THEORY AND EXPERIMENT c32

W. P. M. N. Keizer, J. Sneider, and C. D. deHaan *In its* On Microwave Meas., Transmission and Reception Dec. 1978 9 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

Measurements were made of attenuation at 94 GHz caused by rain on a 935 m terrestrial path since October 1977. Simultaneously, the raindrop size distribution was measured with a distrometer and the rainfall intensity was recorded with three rapid response rain gages spaced about 500 m apart along the propagation path. Using the measured raindrop size distribution and assuming spherical raindrops, the attenuation caused by rain was calculated with the aid of Mie's scattering theory for water spheres. The result is compared with the measured data. In the case of uniform rainfall along the path a good agreement is observed between the measured and the calculated attenuation.

The description of the propagation link, the experimental results, and the comparison between theory and measurement are given. Also, the descrease of antenna gain at 94 GHz due to water on a 1.2 m Cassegrain antenna is discussed. It is shown that for accurate propegation measurements it is absolutely necessary to equip the antennas with protective shelters. Author (ESA)

N80-26564# Physics Lab. RVO-TNO, The Hague (Netherlands).
PROPAGATION MEASUREMENTS AT 94 GHz AND COMPARISON OF EXPERIMENTAL RAIN ATTENUATION WITH THEORETICAL RESULTS DERIVED FROM ACTUALLY MEASURED RAINDROP SIZE DISTRIBUTIONS c32
W. P. M. N. Keizer, J. Sneider, and C. D. deHaan *In its* On Microwave Meas., Transmission and Reception Dec. 1978 7 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

A propagation experiment at 94 GHz designed to provide rain attenuation data on millimeter wave frequencies is discussed. The propagation link, including location, path length, and transmitting as well as receiving antenna characteristics, is described. A comparison between the measured rain attenuation and that calculated from the measured drop size distribution using Mie's scattering theory, is given. Results show better agreement between theory and measurement when using the Mie scattering theory than with other average drop size distributions, such as the Laws-Parsons distribution or the Marshall-Palmer one. The decrease in antenna gain at 94 GHz due to water on a 1.2 m Cassegrain antenna is also pointed out. It is shown that for accurate propagation measurement it is absolutely necessary to equip the antennas with protective shelters. Author (ESA)

N80-26565# Band, Lavis and Associates, Inc., Severna Park, Md.
CLASSIFICATION OF INTACT STABILITY STANDARDS FOR DYNAMICALLY SUPPORTED CRAFT Final Report, Jul. - Oct. 1979
David R. Lavis Oct. 1979 122 p refs
(Contract DOT-CG-806510-A)
(AD-A082161; Rept-117-3; USCG-D-76-79) Avail: NTIS HC A06/MF A01 CSCL 13/10

In recent years there has been an increasing employment of high-speed marine craft dependent on dynamic and air-cushion lift for support and stability. Existing regulations for the safety of ships and craft at sea are based upon displacement mode operation and cannot adequately be applied to high-speed craft when operating with their dynamic or air cushion means of support. As a result, the U.S. Coast Guard has begun a study of stability standards for such craft which is being carried out as part of the Coast Guard's overall Commercial Vessel Safety (CVS) Program. This report presents the results of the second (or classification) task of four-task study of intact-stability standards. Four broad categories of dynamically supported craft are examined: Amphibious Air-Cushion Vehicles (ACV), Rigid-Sidehull Surface-Effect Ships (SES), Hydrofoil Craft Planing Craft. The different methods by which stability in the nondisplacement mode is achieved by each of these categories is examined, along with the various stability related operational hazards to which they can be subjected. Existing stability standards are reviewed. From these examinations and from the results of the background study prepared as Task 1, the four categories of dynamically supported craft considered have been divided into classes for which the same, or similar intact stability standards can apply. Tasks 3 and 4 which have not yet been initiated are designed for the detailed investigation of stability parameters and for the development of recommended stability standards for one, or more, of the categories of craft examined. GRA

N80-26566# Sandia Labs., Albuquerque, N. Mex. Parachute Systems Div.
PARACHUTE/FLOTATION BAG RECOVERY SYSTEM FOR A LARGE RV NOSE CONE
William B. Pepper Mar. 1980 20 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1800) Avail: NTIS HC A02/MF A01

The design and development of a single stage recovery system consisting of a 6 ft diameter guide surface parachute with a 3.5 cubic foot ram air filled flotation bag for ocean recovery of a 120 lb nose cone is described. Recovery producres start with jettisoning a portion of the initial reentry mass before deploying the parachute. DOE

N80-26567# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
HIGH TEMPERATURE FURNACE APPLICATION OF CRYOPUMPS
G. B. McClellan 11 Feb. 1980 11 p refs Presented at the 9th Ann. Symp. of the Florida Chapter of the Am. Vacuum Soc., Tampa, Fla., 11 Feb. 1980
(Contract EY-76-C-04-0656)
(GEPP-OP-483; CONF-800214-2) Avail: NTIS HC A02/MF A01

The basic imcompatibilities of a high temperature, 720 C, furnace and the low temperature, 12 k, cryopump are throughly investigated. The performance of the completed system is extensively investigated and is excellent. Cost comparisons are made with a duplicate diffusion pumped system. DOE

N80-26568# Kaiser Engineers, Oakland, Calif.
SITE AND BUILDING ENERGY-CONSERVATION STUDY: SURVEY OF BUILDING 435, MFE RESEARCH
Oct. 1979 70 p Prepared in cooperation with Consultants Computation Bureau, Oakland, Calif. Prepared for Calif. Univ., Livermore; Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15198; REPT-79-72-RE) Avail: NTIS HC A04/MF A01

Review of the design drawings, an on-site inspection of the 49,700-sq ft building, and discussions with the building manager and various operating personnel are discussed. Data were collected regarding the number of people occupying the building, operating schedules, and the energy loads imposed by installed and temporary equipment. The heating, ventilating, and air conditioning systems were investigated. The building energy systems were simulated using the DOE-1 energy program. A base-year energy consumption run was made, together with simulations of the building's performance assuming installation of each of eleven energy-conservation opportunities (ECO's) identified. A summary of the energy savings that would results from implementation of the ECO's is given. DOE

N80-26569# Military Vehicles and Engineering Establishment, Christchurch (England).
CODE OF PRACTICE FOR ENGINEERING DRAWINGS
London HMSO Sep. 1979 79 p
(MVEE-Proced-101; BR71172) Avail: NTIS HC A05/MF A01

The application of British standards to the preparation of engineering drawings is presented. Some of the most commonly applied standards, specifications, symbols, and abbreviations are listed for reference purposes and examples of completed drawings and diagrams are included. Author (ESA)

N80-26570# Texas Transportation Inst., College Station.
RESIDUAL STRESSES DUE TO TRAVELING LOADS AND REFLECTION CRACKING Interim Report, Sep. 1974 - Jun. 1979
W. O. Yandell and R. L. Lytton Jun. 1979 90 p refs Sponsored in part by Texas State Dept. of Highways and Public Transportation, Austin
(PB-80-159395; FHWA/TX-79/18/207-6; TTI-2-8-75-207-6)
Avail: NTIS HC A05/MF A01 CSCL 13B

The potential capabilities of the three dimensional mechano-lattice stress strain analysis for predicting rut depth, fatigue cracking, corrugations, and reflection cracking are demonstrated. The mechano-lattice analogy is the only techniques available which is capable of predicting the behavior of linear or nonlinear elasto-plastic or energy absorbing material subjected to directional traveling wheel loads. It is rigorous technique that preserves equilbrium and has strain compatibility. The problems investigated are the repeated one directional pneumatic tire rolling on a single layer of a compacted elasto-plastic sand-clay mixture various boundary conditions and the behavior of an elasto-plastic overlay with potential reflection cracking. The build up of residual stresses and strains is demonstrated to have significant effects on the accuracy of present day pavement design and construction procedures, including rutting and fatigue crack prediction. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N80-26571*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FREQUENCY TRACKED PULSE TECHNIQUE FOR ULTRASONIC ANALYSIS Patent Application
John H. Cantrell and Joseph S. Heyman, inventors (to NASA) Filed 10 Jun. 1980 21 p
(NASA-Case-LAR-12697-1; US-Patent-Appl-SN-158183) Avail: NTIS HC A02/MF A01 CSCL 20N

A tracking generator is slaved to a spectrum analyzer to produce an input signal having a frequency that follows the frequency of the spectrum analyzer sweeping local oscillator. The input signal is gated to a transducer by a transmitter gate to produce ultrasonic waves in the sample. The resulting ultrasonic echoes are converted into electrical signals by the transducer and then gated into the spectrum analyzer by receiver gate. This arrangement produces spectra that are equivalent to shock-exciting the transducer with a true delta function shock-excitation. NASA

N80-26572*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ELECTRO-OPTICS LABORATORY EVALUATION: DEUTSCH OPTICAL WAVEGUIDE CONNECTORS
Jun. 1980 39 p
(NASA-TM-74108: KSC-TR-32-1) Avail: NTIS HC A03/MF A01 CSCL 17B

A description of a test program evaluating the performance of an optical waveguide connector system is presented. Both quality and effectiveness of connections made in an optical fiber, performance of the equipment used and applicability of equipment and components to field conditions are reviewed. E.D.K.

N80-26573*# Telephonics, Huntington, N.Y.
WIRELESS MICROPHONE COMMUNICATION SYSTEM TELEPHONICS P/N 484D000-1
[1980] 281 p
(Contract NAS9-14824)
(NASA-CR-160731: WMCS-001) Avail: NTIS HC A13/MF A01 CSCL 17B

The wireless microphone is a lightweight, portable, wireless voice communications device for use by the crew of the space shuttle orbiter. The wireless microphone allows the crew to have normal hands-free voice communication while they are performing various mission activities. The unit is designed to transmit at 455 or 500 kilohertz and employs narrow band FM modulation. Two orthogonally placed antennas are used to insure good reception at the receiver. E.D.K.

N80-26574*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPUTER PROGRAM TO CALCULATE RADIATION PROPERTIES OF REFLECTOR ANTENNAS
Pradeep K. Agrawal May 1978 77 p refs
(NASA-TM-78721) Avail: NTIS HC A05/MF A01 CSCL 20N

A computer program to calculate the radiation properties of the reflector antennas is presented. It can be used for paraboloidal, spherical, or ellipsoidal reflector surfaces and is easily modified to handle any surface that can be expressed analytically. The program is general enough to allow any arbitrary location and pointing angle for the feed antenna. The effect of blockage due to the feed horn is also included in the computations. The computer program is based upon the technique of tracing the rays from the feed antenna to the reflector to an aperture plane. The far field radiation properties are then calculated by performing a double integration over the field points in the aperture plane. To facilitate the computation of double intergral, the field points are first aligned along the equispaced straight lines in the aperture plane. The computation time is relatively insensitive to the absolute size of the aperture and even though no limits on the largest reflector size have been determined, the program was used for reflector diameters of 1000 wavelenghts. E.D.K.

N80-26575*# National Aeronautics and Space Administration, Washington, D. C.
COMMUNICATIONS VIA THE RADIO ARTIFICIAL EARTH SATELLITE: DESIGN OF THE TRACKING DIAGRAM AND FEATURES FOR CONDUCTING QSO
V. Dobrozhanskiy and V. Rybkin Mar. 1980 17 p refs Transl. into ENGLISH from Provedennya QSO Radio. (USSR), no. 1, 1979 p 17-20 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76105) Avail: NTIS HC A02/MF A01 CSCL 17B

A detailed examination is made of the operation of a transmitting artifical Earth satellite. A tracking diagram for the satellite is constructed. The zone of radio visibility can be determined based on the techniques proposed. Author

N80-26576*# Axiomatix, Los Angeles, Calif.
SHUTTLE ORBITER KU-BAND RADAR/COMMUNICATIONS SYSTEM DESIGN EVALUATION. KU BAND BENT-PIPE CHANNEL PERFORMANCE EVALUATION Interim Report
Jack K. Holmes and James G. Dodds 20 Jun. 1980 54 p refs
(Contract NAS9-15795)
(NASA-CR-160696; RB006-5) Avail: NTIS HC A04/MF A01 CSCL 17I

Because of difficulties with the bit detector of the SPA mode 1 channel 3 input port, a new bit synchronizer was required. The two prime candidate designs are described and analyzed. The selected design is a modification of one which utilizes a phase frequency detector to track the received data clock frequency and a mid-bit transition point sample detector to generate a bit timing error (phase error) signal to control the relative phase between the local clock and the local data stream. The model used to calculate the effects of cable attenuation and rise time degradation is discussed. A.R.H.

N80-26577*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Dept. of Space.
CUMULATIVE SLANT PATH RAIN ATTENUATION ASSOCIATED WITH COMSTAR BEACON AT 28.56 GHz FOR WALLOPS ISLAND, VIRGINIA
Julius Goldhirsh Aug. 1978 33 p refs
(NASA Order S-50748-A)
(NASA-CR-159997; APL/JHU-SIR78U-039) Avail: NTIS HC A03/MF A01 CSCL 20N

Yearly, monthly, and time of day fade statistics are presented and characterized. A 19.04 GHz yearly fade distribution, corresponding to a second COMSTAR beacon frequency, is predicted using the concept of effective path length, disdrometer, and rain rate results. The yearly attenuation and rain rate distributions follow with good approximation log normal variations for most fade and rain rate levels. Attenuations were exceeded for the longest and shortest periods of times for all fades in August and February, respectively. The eight hour time period showing the maximum and minimum number of minutes over the year for which fades exceeded 12 db were approximately between 1600 to 2400, and 0400 to 1200 hours, respectively. In employing the predictive method for obtaining the 19.04 GHz fade distribution, it is demonstrated theoretically that the ratio of attenuations at two frequencies is minimally dependent of raindrop size distribution providing these frequencies are not widely separated. E.D.K.

N80-26578# Electronics Research Lab., Adelaide (Australia).
RADAR EMITTER RECOGNITION USING PULSE REPETITION INTERVAL
R. M. Hawkes Mar. 1980 57 p refs
(ERL-0132-TR; AR-001-976) Avail: NTIS HC A04/MF A01

A method for estimating radar emitter pulse repetition interval parameters from intercepted emissions is presented. Adaptive parameter estimates based on certain measurements are derived. The measurements are obtained by a readily implementable

observation procedure. The approach can deal with emitters with variable pulse repetition interval in a dense environment. Computer simulation results for the techniques are included.
Author

N80-26579*# Stanford Univ., Calif. Dept. of Engineering Systems.
COST COMPARISON OF COMPETING LOCAL DISTRIBUTION SYSTEMS FOR COMMUNICATION SATELLITE TRAFFIC
Frederick E. Dopfel Oct. 1979 15 p ref
(Contract NASw-3204)
(NASA-CR-163282; SU-26) Avail: NTIS HC A02/MF A01 CSCL 17B

The boundaries of market areas which favor various means for distributing communications satellite traffic are considered. The distribution methods considered are: control Earth station with cable access, rooftop Earth stations, Earth station with radio access, and various combinations of these methods. The least cost system for a hypothetical region described by number of users and the average cable access mileage is discussed. The region is characterized by a function which expresses the distribution of users. The results indicate that the least cost distribution is central Earth station with cable access for medium to high density areas of a region combined with rooftop Earth stations or (for higher volumes) radio access for remote users.
B.D.

N80-26580*# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
AN ILLUSTRATIVE ANALYSIS OF TECHNOLOGICAL ALTERNATIVES FOR SATELLITE COMMUNICATIONS
Murray R. Metcalfe, Edward G. Cazalet, and D. Warner North Oct. 1979 78 p refs
(Contract NASw-3204)
(NASA-CR-163281; SU-24) Avail: NTIS HC A05/MF A01 CSCL 17B

The demand for satellite communications services in the domestic market is discussed. Two approaches to increasing system capacity are the expansion of service into frequencies presently allocated but not used for satellite communications, and the development of technologies that provide a greater level of service within the currently used frequency bands. The development of economic models and analytic techniques for evaluating capacity expansion alternatives such as these are presented. The satellite orbit spectrum problem, and also outlines of some suitable analytic approaches are examined. Illustrative analysis of domestic communications satellite technology options for providing increased levels of service are also examined. The analysis illustrates the use of probabilities and decision trees in analyzing alternatives, and provides insight into the important aspects of the orbit spectrum problem that would warrant inclusion in a larger scale analysis.
B.D.

N80-26581*# National Aeronautics and Space Administration, Washington, D. C.
RADIO EMISSION EVOLUTION OF NONSTATIONARY SOURCES IN THE HEDGEHOG MODEL
Yu. A. Kovalev and V. P. Mikhaylutsa Jun. 1980 24 p refs Transl. into ENGLISH of 'Evolyutsiya Radioizlucheniya Nestatsionarnykh Istochnikov v Modeli Yezhik", Rept. Pr-324, Moscow, 1977 p 1-26 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academy of Sciences (USSR)
(Contract NASw-3198)
(NASA-TM-76210; PR-324) Avail: NTIS HC A02/MF A01 CSCL 20N

Correlations are obtained for numerical calculation of flux F sub v and polarized radiation intensity of a cloud of arbitrary geometry, consisting of ultrarelativistic electrons that dissipate in a radial magnetic field of the nucleus at a random angle to the observer. It is possible that some of the variable extragalactic objects that were previously described by the Shklovskiy model are young formations in the examined model. Radio astronomical observations would permit a determination of their distance, age, and lifetime.
E.D.K.

N80-26582# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
NEAR MILLIMETER WAVE RADAR TECHNOLOGY, PHASE 1 Interim Report
R. W. McMillan, R. E. Forsythe, R. A Bohlander, R. G. Shackelford, R. N. Trebits, and W. A. Holm 11 Jan. 1980 106 p refs
(Contract DAAK70-79-C-0108)
(AD-A083493) Avail: NTIS HC A06/MF A01 CSCL 17/9

The proposed system consists of a transmitter, receiver, antenna duplexer, and antenna subsystem. An attempt will be made to phase lock the Varian VKY-2429R EIO transmitter to the receiver local oscillator to give a quasi-coherent system. Quasi-coherent means that the transmitted pulse is coherent near its center and incoherent during rise and fall times. The receiver will be of all solid state design, using an 1/4 subharmonic mixer developed at Georgia Tech together with a Hughes 55 GHz phase locked Gunn local oscillator. The antenna duplexer will be an optical subsystem, depending partially for its operation on the change in sense of circular polarization when reflected from a single-bounce target, and partially on the operation of an interferometric switch used for receiver isolation. The antenna will be a 15 cm (6 inch) lens machined from a piece of TPX plastic, and the beam will be steered by a 2-axis gimbal system. Although there will be no signal processing hardware included in the proposed system, the antenna will have both a raster scan mode for search and a conical scan mode for track. The entire system will be designed to be amendable to the addition of radar signal processing at a later time.
GRA

N80-26583# California Univ., San Diego. Dept. of Electrical Engineering and Computer Sciences.
A SIMPLIFIED THEORY OF ELF PROPAGATION IN THE EARTH-IONOSPHERE TRANSMISSION LINE AND ITS WORLDWIDE APPLICATION Final Report, 1 Aug. 1978 - 31 Mar. 1980
Henry G. Booker 31 Mar. 1980 174 p refs
(Contract N00014-78-C-0682)
(AD-A083097) Avail: NTIS HC A08/MF A01 CSCL 20/14

An approximate theory of ELF propagation in the Earth-ionosphere transmission line is developed by combining the reflection theory of Booker and Lefeuvre (1977) with Greifinger and Greifinger's treatment S1978, 1979) of the effect of ionization below the level of reflection. The theory allows for the influence of the Earth's magnetic field, for reflection from the gradient on the under side of the D region (or, at night, of a ledge below the E region), for reflection from the gradient on the under side of the E region, and for reflection from the gradient on the top side of the E region. The procedure is to compare local vertical gradient with local wavelength, thereby classifying altitude into intervals where the gradient is high and ones where it is low. Where the gradient is low, the phase-integral treatment is adequate. An interval where the gradient is high may, to a first approximation, be replaced by a discontinuity. The amount of the discontinuity is the difference between the refractive indices at the top and bottom of the interval of high gradient, judged in relation to local wavelength. It is then a matter of combining reflections from the several discontinuities. This requires calculation of the complex phase-changes between the discontinuities. But these are the intervals where the phase-integral treatment is available. To a better approximation, there is a non-zero phase-change associated with an interval of high gradient. The method for incorporating this is described.
GRA

N80-26584# Oklahoma State Univ., Stillwater. Electronics Lab.
TRADAT MICROCOMPUTER BASED TRAJECTORY SYSTEM
R. M. Fike Hanscom AFB, Mass. AFGL 30 Nov. 1979 79 p refs
(Contract F19628-78-C-0033; AF Proj. 7659)
(AD-A083074; SCIENTIFIC-1; AFGL-TR-80-0012) Avail: NTIS HC A05/MF A01 CSCL 16/1

Tradat V is a lightweight, relatively inexpensive trajectory data system which was designed to be used with a portable autotrack antenna system. The combined Tradat V/Tracker system provides trajectory data for vehicles such as sounding rockets or balloons which are launched at remote launch sites where there are no fixed site radar sets. The tracker provides telemetry reception and the azimuth and elevation angles to the vehicle and the Tradat V system provides the following: slant range to

better than + or - .05 KM RMS, using a PCM ranging system in conjunction with the vehicle telemetry system; a serial PCM trajectory data code (for tape recording) containing: (a) Time, (b) Status indicators, (c) Raw azimuth, elevation, and slant range data; and a microcomputer printout containing: (a) Time, (b) Status indicators, (c) Computed ellipsoidal Earth coordinate data (Mean sea level altitude, ground range, distance North, and distance East or mean sea level altitude, vehicle latitude, and vehicle longitude), (d) Azimuth, elevation, and slant range referenced to one of three selectable data origin sites. This report contains an electrical and physical description of the Tradat V system, set-up and operation procedures, description of an optional command through ranging system, a microcomputer software description and equation derivation section, discussion of Tradat V mission results. GRA

N80-28585# Ohio State Univ., Columbus. Electroscience Lab.

A CAVITY-TYPE BROADBAND ANTENNA WITH A STEERABLE CARDIOID PATTERN *Final Report*

B. A. Munk and C. J. Larson Dec. 1979 92 p refs

(Contract N00014-78-C-0855)

(AD-A083226; ESL-711559-2) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report describes a new vertically polarized cavity-type antenna with a cardioid pattern steerable in the horizontal plane. The front-to-back ratio is better than 15 dB over a 25% bandwidth and better than 20 dB within half that total bandwidth. The average gain is approximately 2 dB above a monopole and the VSWR-2 except at the very end of the band. The beamwidth in the front as well as the nullwidth in the back is so wide that the beam is directed only in the four cardinal directions in the horizontal plane. A working model will be delivered to NRL as part of the contract. GRA

N80-28586# Naval Environmental Prediction Research Facility, Monterey, Calif.

ANOMALOUS MICROWAVE PROPAGATION ASSESSMENT IN THE LOWER TROPOSPHERE USING A BULK METEOROLOGICAL PARAMETER *Final Report*

Wayne Sweet Feb. 1980 24 p refs

(AD-A083156; NEPRF-TR-80-01) Avail: NTIS HC A02/MF A01 CSCL 20/14

In their 1967 study 'On the Influence of the Meteorological Conditions on the Radiation Properties of Long Range Radars and on the Field Strength From a Distant Radio Transmitter,' Gjessing and Moene (G M) developed a procedure which uses a delta N parameter evaluated at the 850 mb level to assess the propagation properties for microwave transmissions. This present study examines the skill of the G M procedure to determine resulting accuracy, optimum value of delta N, and preferred vertical region of assessment. EASTPAC radiosonde soundings are used to determine the refractive structure in the given vertical region, and to calculate the value of delta N (850 mb). The G M procedure's skill is found to be comparable to, or in some cases better than, the skill of present day weather forecasts. The G M procedure is found to have skill in assessing the existence of anomalous propagation between the surface and the 850 mb level with no indication to the vertical location within this region. The optimum value of delta N is found to be similar to that used by Gjessing and Moene. GRA

N80-28587# Naval Research Lab., Washington, D. C. Radar Div.

NONLINEAR SPECTRAL ANALYSIS AND ADAPTIVE ARRAY SUPERRESOLUTION TECHNIQUES *Interim Report*

William F. Gabriel 1 Feb. 1980 28 p refs

(RR0210541, WR02101002)

(AD-A083391; AD-E000390; NRL-8345) Avail: NTIS HC A03/MF A01 CSCL 09/5

Two nonlinear spectral analysis techniques, the Burg maximum entropy method and the maximum likelihood method, are related to their similar nonlinear adaptive array antenna counterparts, which consist of the sidelobe canceller and directional gain constraint techniques. The comparison analysis permits an examination of their principles of operation from the antenna spatial pattern viewpoint, and helps to qualify their superresolution performance. The real-time adaptive resolution of two incoherent sources located within a beamwidth was simulated, and results are presented in the form of a universal superresolution curve over a SNR range of 0 to 40 dB. Two alternative adaptive spatial spectrum estimators are suggested, consisting of a circular array predicting to its center point, and a new 'thermal noise' algorithm. GRA

N80-28588# Lincoln Lab., Mass. Inst. of Tech., Lexington.

A HIGH PERFORMANCE UHF SATELLITE TRANSMITTER

Mark L. Stevens 28 Nov. 1979 86 p refs

(Contract F19628-80-C-0002)

(AD-A083262; TN-1979-68; ESD-TR-79-273) Avail: NTIS HC A05/MF A01 CSCL 17/2

This note describes the design, construction, and performance of a 50 W UHF satellite transmitter which was built to demonstrate design and construction techniques that lead to easy replication of circuits in a manufacturing environment, without sacrifice in performance. High-efficiency performance is demonstrated over a 20 MHz band, centered at 260 MHz, with a fixed-tuned, single-ended design. GRA

N80-28589# Lincoln Lab., Mass. Inst. of Tech., Lexington.

PATTERN DEGRADATION OF SPACE FED PHASED ARRAYS

John Ruze 5 Dec. 1979 144 p refs

(Contract F19628-80-C-0002; ARPA Order 3724)

(AD-A083264; SBR-1; ESD-TR-79-278) Avail: NTIS HC A07/MF A01 CSCL 17/9

The far field pattern degradation of space fed phased arrays suitable for a space based radar is examined. The effects considered are: Structural; (1) Axial lens surface distortions, (2) Uniform radial thermal expansion, and (3) Axial and lateral feed displacements; Electrical; (1) Element phase and amplitude excitation errors, and (2) Failed elements. An introductory section discusses the size, cost, and weight penalties of low sidelobe designs. The final section presents a method of phase compensation or coherence of large axial lens distortions. GRA

N80-28590# Ohio State Univ., Columbus. Electroscience Lab.

ON GRATING NULLS IN ADAPTIVE ARRAYS

A. Ishide and R. T. Compton, Jr. Mar. 1980 38 p refs

(Contract N00019-79-C-0281)

(AD-A083687; ESL-711847-8) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report considers the effect of element patterns on grating nulls in adaptive arrays. Two simple array models, a two-element and a three-element array with dipole element patterns, are used to study this question. The element patterns are assumed unequal (i.e., the beam maxima point in different directions). It is shown that element patterns greatly affect the occurrence of grating nulls in the array. Unequal element patterns cause extra grating nulls (sign reversal grating nulls) to occur, in addition to conventional grating nulls. These sign reversal grating nulls can occur even with element spacing less than a half-wavelength. For a two-element array with dipole element patterns, it turns out that grating nulls cannot be avoided if the spacing is greater than a half wavelength. However, with more than two elements, the situation is not so bleak. An example is given of a three-element array with dipole patterns and one wavelength spacing in which all grating nulls are eliminated. GRA

N80-28591# Naval Postgraduate School, Monterey, Calif.

CLUTTER SUPPRESSION IN RADARS BY AN APPLICATION OF DIGITAL FILTERS TO MTI SYSTEMS *M.S. Thesis*

John Elias Sarris Dec. 1979 82 p refs

(AD-A083837) Avail: NTIS HC A05/MF A01 CSCL 17/9

A significant part of radar technology has been concerned with developing techniques which permit satisfactory operation of radar systems when moving targets are in the presence of relatively fixed targets (clutter). This thesis presents the significant aspects of old, improved and modern anticlutter techniques, each of which is described with its principal advantages and disadvantages. A tabulation is made which compares each anticlutter technique on the basis of its clutter suppression capability. Continuing, an application of digital filters is made by designing a fourth-order recursive filter with Butterworth characteristics, using a computer program. This filter can be used in a range-gated

MTI (Moving Target Indication) receiver to improve its performance. Special consideration was given to the AN/UPS-1 and AN/SPS-40B,C radars which are used in the Greek Navy in a clutter environment characteristic of the Mediterranean Sea. Appropriate modifications to their existing analog systems are suggested. GRA

N80-26592# Los Alamos Scientific Lab., N. Mex.
TRANSIENT RESPONSE OF THIN-WIRE ANTENNAS AND SCATTERERS LOADED WITH CIRCUITS AND NONLINEAR ELEMENTS
J. A. Landt Feb. 1980 16 p refs Sponsored in part by Dept. of Agriculture
(Contract W-7405-eng-36)
(LA-8242-MS) Avail: NTIS HC A02/MF A01

A numerical technique is presented that is capable of calculating the transient response of a thin-wire antenna or scatterer loaded by a network. The network contains nonlinear as well as linear elements. The numerical solution is obtained by a single computer code execution. The formation is cast in the time domain, and the solution is obtained by a time stepping procedure. DOE

N80-26593# National Physical Lab., Teddington (England). Div. of Electrical Science.
THE PROPAGATION OF PLANE WAVES THROUGH A LAMELLA
R. J. Cook Aug. 1979 15 p refs
(NPL-DES-52) Avail: NTIS HC A02/MF A01

Single and multiple reflections were considered in deriving expressions, in terms of the refractive index n and the absorption index K, for the power transmission coefficient, power reflection coefficient and phase shifts for a Lamella placed in a plane wave at normal incidence. The expressions were successfully used in a free space microwave bridge to compare transmission and reflection measurements on the same sample. Author (ESA)

N80-26594# GEC-Marconi Electronics Ltd., Chelmsford (England). Communications Research Lab.
ON-BOARD SYNTHETIC APERTURE RADAR (SAR) PROCESSOR DEFINITION Final Report
S. R. Brooks, A. P. Luscombe, and A. B. E. Ellis Oct. 1979 264 p refs
(Contract ESTEC-2897/76)
(MTR-79/96; ESA-CR(P)-1284) Avail: NTIS HC A12/MF A01

A spaceborne synthetic aperture radar (SAR) system which utilizes onboard image processing in real time is described. The system components (radar, antenna, platform, data link) are considered, leading to an evaluation of processor performance requirements within the constraints of given image quality specifications. The system analysis is developed to quantify the processor operations. The implementation of the processing is studied for several candidate processor designs. Storage and data rates are emphasized. Results favor the digital approach. The availability of suitable devices limits the analog approach, while its subsequent stability is found to be difficult to maintain and monitor. Author (ESA)

N80-26595# Oulu Univ. (Finland). Dept. of Electrical Engineering.
A MICROCOMPUTER BASED MEASUREMENT AND MAIN LOBE CONTROL SYSTEM FOR AN ARRAY ANTENNA
Simo Lehto, Jorma Kekaelaeinen, and Jorma Kajava 1978 16 p refs
(S-52-1978; ISBN-951-42-0578-2; ISSN-0356-0899) Avail: NTIS HC A02/MF A01

A microcomputer based measurement and main lobe control system is presented. It was designed and constructed for a three stack, two bay array antenna for medium and long distance HF communication. The antenna system is used to gather and process ionospheric and propagation data (amplitude distribution of received signals, slow and fast fading, and the quality of the received signal). The main lobe of the array can also be automatically directed to the direction of the best propagation modes. The research antenna system is presently being used for propagation studies and tests in practical world-wide communications for assessing the effect of main lobe control on the short term and long term performance of HF antennas. Author (ESA)

N80-26596# Oulu Univ. (Finland). Dept. of Electrical Engineering.
MODELING AND OPTIMIZATION OF TRANSMITTING ARRAY ANTENNAS IN THE PRESENCE OF IMPERFECT GROUND
Simo Lehto, Jorma Kekaelaeinen, Jorma Kajava, and Kalevi Kalliomaeki, ed. 1978 22 p refs
(S-53-1978; ISBN-951-42-0579-0; ISSN-0356-0899) Avail: NTIS HC A02/MF A01

An arbitrarily oriented antenna system consisting of an array of N antennas and a test antenna above the imperfect ground is described by (N+1) -port network. By using the field representation, the result shows how the ground parameters are incorporated into the model. The radiation pattern, directivity, and the power gain of the array are formulated in the transmitting case. The optimum excitations which maximize the directivity, and the power gain, are obtained as solutions of the corresponding eigenvalue equations. Author (ESA)

N80-26597# Stanford Univ., Calif.
NEW TECHNICAL OPPORTUNITIES FOR UHF TELEVISION TRANSMITTERS
C. Chapin Cutler Feb. 1980 50 p refs
(Contract FCC-2184-9)
(PB80-137193) Avail: NTIS HC A03/MF A01 CSCL 17B

The prospects for improved efficiency in power amplifying devices for UHF broadcast television transmitters are examined. Estimates of dollar and power savings are presented for a number of devices. GRA

N80-26598# Aeronautical Radio, Inc., Annapolis, Md.
SHIP DATA COMMUNICATIONS SYSTEM (SDCS): A STUDY OF FEASIBILITY AND COST-BENEFIT ANALYSIS FOR THE UNITED STATES - FLAG MERCHANT FLEET Final Report, Sep. 1978 - Jan. 1980
L. B. Greene Jan. 1980 77 p
(Contract MA-8-3085)
(PB80-158645; MA-RD-930-80025; ARINC-1353-02-1-2031) Copyright. Avail: NTIS HC A05/MF A01 CSCL 17B

The results of a study of shipboard data communications to determine the requirements for ship-to-shore data communications, to determine the availability of ship-to-shore data communications systems, to compare these systems in terms of costs and benefits, and to make recommendations for future implementation of these systems are presented. The resulting analysis of costs and benefits of each communications mode established the maritime satellite (MARIST) high data rate service as clearly superior to any other mode at all volume levels. GRA

N80-26343*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SETI OBSERVATIONAL PLAN
A. L. Berman *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 43-49 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-26344*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ERROR ESTIMATION FOR ORION BASELINE VECTOR DETERMINATION
S. C. Wu *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 16-31 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-26346*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN COMMAND SYSTEM MARK III-80
H. C. Thorman *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 35-42 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-26352*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE 64 METER ANTENNA OPERATION AT X SUB A BAND
P. D. Potter *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 65-70 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-26354*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RFI RECEIVER
R. Lay *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 82-86 ref (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-26360*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
UTILIZATION OF THE VENUS STATION (DSS 13) 26 METER ANTENNA DURING CY 1979
E. B. Jackson *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 136 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N80-26552# Physics Lab. RVO-TNO, The Hague (Netherlands).
CHARACTERISTICS OF CLUTTER AND TARGETS AT X- AND Ku-BANDS
H. Sittrop *In its* On Microwave Meas., Transmission and Reception Dec. 1978 28 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26553# Physics Lab. RVO-TNO, The Hague (Netherlands).
SEA-CLUTTER DEPENDENCY ON WINDSPEED
H. Sittrop *In its* On Microwave Meas., Transmission and Reception Dec. 1978 4 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26554# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE DESIGN CONSTRUCTION AND TEST RESULTS OF THE CAISSA PLANAR SPACE FED PHASED ARRAY ANTENNA
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 13 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26555# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE PERFORMANCE OF AN IRIS-LOADED PLANAR PHASED-ARRAY ANTENNA OF RECTANGULAR WAVE-GUIDES WITH AN EXTERNAL DIELECTRIC SHEET
H. J. vanSchaik *In its* On Microwave Meas., Transmission and Reception Dec. 1978 8 p refs Repr. from IEEE Trans. on Antennas and Propagation, v. AP-26, no. 3 May 1978 8 p (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26556# Physics Lab. RVO-TNO, The Hague (Netherlands).
THEORETICAL AND EXPERIMENTAL RESULTS OF AN IRIS-LOADED PLACAR PHASED-ARRAY ANTENNA WITH AN EXTERNAL DIELECTRIC SHEET
H. J. vanSchaik *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26557# Physics Lab. RVO-TNO, The Hague (Netherlands).
NUMERICAL AND EXPERIMENTAL ANTENNA PATTERNS OF A SPACE-FED PLANAR PHASED-ARRAY ANTENNA
H. J. vanSchaik *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26558# Physics Lab. RVO-TNO, The Hague (Netherlands).
A SIMPLE AND FAST MATCHING METHOD FOR MUTUAL COUPLING OF A LINEAR PHASED ARRAY ANTENNA WITH WAVEGUIDE APERTURES AS RADIATING ELEMENTS
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26583# Physics Lab. RVO-TNO, The Hague (Netherlands).
RAIN ATTENUATION MEASUREMENTS AT 94 GHz: COMPARISON OF THEORY AND EXPERIMENT
W. P. M. N. Keizer, J. Sneider, and C. D. deHaan *In its* On Microwave Meas., Transmission and Reception Dec. 1978 9 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26584# Physics Lab. RVO-TNO, The Hague (Netherlands).
PROPAGATION MEASUREMENTS AT 94 GHz AND COMPARISON OF EXPERIMENTAL RAIN ATTENUATION WITH THEORETICAL RESULTS DERIVED FROM ACTUALLY MEASURED RAINDROP SIZE DISTRIBUTIONS
W. P. M. N. Keizer, J. Sneider, and C. D. deHaan *In its* On Microwave Meas., Transmission and Reception Dec. 1978 7 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-26589* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
PORTABLE DEVICE FOR USE IN STARTING AIR-START-UNITS FOR AIRCRAFT AND HAVING CABLE LEAD TESTING CAPABILITY Patent
William R. Rosier (Serv-Air, Inc., Edwards, Calif.) and George G. Volk, inventors (to NASA) (Serv-Air, Inc., Edwards, Calif.) Issued 20 May 1980 7 p Filed 9 Mar. 1978 Supersedes N78-19166 (16 - 10, p 1263) Sponsored by NASA (NASA-Case-FRC-10113-1; US-Patent-4,204,154; US-Patent-Appl-SN-885066; US-Patent-Class-324-51) Avail: US Patent and Trademark Office CSCL 09C

A portable device for starting aircraft engines and the like is disclosed. The device includes a lead testing and motor starting circuit characterized by: (1) a direct current voltage source, (2) a pair of terminal plugs connected with the circuit (each being characterized by a first, second, and third terminal) (3) a pair of manually operable switches for connecting the first terminal of each plug of the pair to the positive side of the voltage source, (4) a circuit lead connecting to the second terminal of each plug the negative side of said source, (5) a pair of electrical cables adapted to connect said first and second terminals of each plug to an air-start unit, and means for connecting each cable of the pair of cables between the first terminal of one plug and the third terminal of the other plug of the pair, and (6) a second pair of manually operable switches for selectivity connecting the third terminal of each plug of the pair to the negative side of the voltage source.

Official Gazette of the U.S. Patent and Trademark Office

N80-26600# Environmental Law Inst., Washington, D. C.
STATE OPTIONS IN LIGHTING: EFFICIENCY STANDARDS FOR EXISTING PUBLIC BUILDINGS
Frank Meeker Jun. 1979 51 p refs
(Contract EM-78-C-01-5255)
(DOE/CS-5255/2) Avail: NTIS HC A04/MF A01

Requirements and options for state lighting efficiency standards for existing public buildings under the Energy Policy and Conservation Act are discussed. It is recommended that

states adopt a requirement that owners of all public buildings submit reports of lighting energy audits and estimates of energy savings from modifications to comply with substantive standards. It is further recommended that while filing of reports should be mandatory, substantive compliance, at least initially, need not be. It is recommended that exemptions from the standards be limited to small buildings and that variances under a mandatory standard be available only when an applicant can show insufficient capital to make required modifications, even though they would soon pay for themselves in reduced operating costs. It is suggested that a lighting standard of the kind recommended should substantially reduce wasted energy in lighting, be simple enough to be easily understood and applied, be technically and economically reasonable, and allow for needed exemptions without loopholes. E.D.K.

N80-26601*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
JFET OSCILLATOR Patent Application
Leonard L. Kleinberg, inventor (to NASA) Filed 27 May 1980 14 p
(NASA-Case-GSC-12555-1; US-Patent-Appl-SN-153240) Avail: NTIS HC A02/MF A01 CSCL 09A

A high frequency oscillator circuit is described. The circuit uses a low cost junction type field effect transistor (T sub 1) with a tuned circuit connected to its gate. The frequency of operation is determined by the tuned circuit and the capacitance reflected from the the source to the gate. The transistor is matched to the grequency of operation so that this frquency falls within the roll-off portion of the transistor's transconductance verses frequency curve, above the 3 db point in frequency. Phase shifting necessary to sustain oscillation occur to the operation of the transistor in the roll off portion of the curve and the addition of a phase shifting network (R sub 1 C) at the source. The resulting oscillator is small, stable, linear, and inexpensive. NASA

N80-26602*# Mississippi State Univ., Mississippi State. Microelectronics Research Lab.
A STUDY OF TRENDS AND TECHNIQUES FOR SPACE BASE ELECTRONICS Quarterly Progress Report, 10 Mar. - 10 Jun. 1978
J. D. Trotter, T. E. Wade, J. D. Gassaway, and Q. Mahmood Jun. 1978 24 p refs
(Contract NAS8-26749; MSU-EE-QUAR-3-78)
(NASA-CR-163293) Avail: NTIS HC A02/MF A01 CSCL 09C

A sputtering system was developed to deposit aluminum and aluminum alloys by the dc sputtering technique. This system is designed for a high level of cleanliness and for monitoring the deposition parameters during film preparation. This system is now ready for studying the deposition and annealing parameters upon double-level metal preparation. A technique recently applied for semiconductor analysis, the finite element method, was studied for use in the computer modeling of two dimensional MOS transistor structures. It was concluded that the method has not been sufficiently well developed for confident use at this time. An algorithm was developed for confident use at this time. An algorithm was developed for implementing a computer study which is based upon the finite difference method. The program which was developed was modified and used to calculate redistribution data for boron and phosphorous which had been predeposited by ion implantation with range and straggle conditions. Data were generated for <111> oriented SOS films with redistribution in N2, dry O2 and steam ambients. J.M.S.

N80-26603*# RCA Solid State Technology Center, Somerville, N. J.
CHARACTERIZATION OF SILICON-GATE CMOS/SOS INTEGRATED CIRCUITS PROCESSED WITH ION IMPLANTATION Final Report, 1 Jul. 1976 - 30 Jun. 1977
D. S. Woo Aug. 1977 52 p ref
(Contract NAS8-31986)
(NASA-CR-150607; PRRL-77-CR-40) Avail: NTIS HC A04/MF A01 CSCL 09A

Progress in developing the application of ion implantation techniques to silicon gate CMOS/SOS processing is described. All of the conventional doping techniques such as in situ doping of the epi-film and diffusion by means of doped oxides are replaced by ion implantation. Various devices and process parameters are characterized to generate an optimum process by the use of an existing SOS test array. As a result, excellent circuit performance is achieved. A general description of the all ion implantation process is presented. E.D.K.

N80-26604*# Boeing Aerospace Co., Seattle, Wash.
GROUND/BONDING FOR LARGE SPACE SYSTEM TECHNOLOGY (LSST) Final Report
W. G. Dunbar Apr. 1980 93 p refs
(Contract NAS8-33432)
(NASA-CR-161486) Avail: NTIS HC A05/MF A01 CSCL 09C

The influence of the environment and extravehicular activity remote assembly operations on the grounding and bonding of metallic and nonmetallic structures is discussed. Grounding and bonding philosophy is outlined for the electrical systems and electronic compartments which contain high voltage, high power electrical and electronic equipment. The influence of plasma and particulate on the system was analyzed and the effects of static buildup on the spacecraft electrical system discussed. Conceptual grounding bonding designs are assessed for capability to withstand high current arcs to ground from a high voltage conductor and electromagnetic interference. Also shown were the extravehicular activities required of the space station and or supply spacecraft crew members to join and inspect the ground system using manual on remote assembly construction. DOE

N80-26605# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
SPEED CONTROL OF A FIELD CONTROLLED DC MOTOR
M. Pachter Oct. 1979 18 p refs
(CSIR-TWISK-120) Avail: NTIS HC A02/MF A01

An optimal (minimal time) feedback control law is synthesized. Speed control of a field controlled DC motor in a battery driven vehicle application is considered. B.D.

N80-26606# Naval Research Lab., Washington, D. C. Microwave Technology Branch.
INTERACTIVE EFFECTS OF BOND WIRES USED FOR MICROWAVE SEMICONDUCTOR DEVICE COMBINING AND MATCHING CIRCUITRY Interim Report
R. E. Neidert, H. A. Willing, and B. E. Spielman 5 Mar. 1980 11 p refs Submitted for publication
(RR0210346)
(AD-A083920; NRL-8388) Avail: NTIS HC A02/MF A01 CSCL 09/1

For arrays of bond wires, inter-wire coupling can significantly affect the parameters of the individual wires. Design information is given for two port problems consisting of multiple bond wire arrays over a ground plane. Secondly, bond wire coupling can degrade the combining efficiency of several wire-combined solid state devices (such as transistor unit cells). This problem is modeled and analyzed, and remedies are suggested. GRA

N80-26607# California Univ., Livermore. Lawrence Livermore Lab.
TEST OF A VACUUM/DIELECTRIC SURFACE FLASHOVER SWITCH
Ian D. Smith (Ian D. Smith, Inc.) 25 Feb. 1980 13 p Prepared jointly with DARPA
(Contracts W-7405-eng-48; N60921-80-PO-w001; ARPA Order 3718)
(UCID-18553) Avail: NTIS HC A02/MF A01

A vacuum surface flashover switch is being considered for >10 kHz operation in a 250 kV, 10 ohm, 40 ns coaxial water Blumlein. Various possible switch designs are compared and two promising ones selected for tests in a switch test facility. The initial test configurations are described. DOE

N80-26608# Sandia Labs., Albuquerque, N. Mex.
SEMICONDUCTORS FOR HIGH TEMPERATURE ACTIVE DEVICES: SILCON, GaAs, AND GaP
Joe Allen Coquat 1980 10 p refs Presented at the Electro/80 Professional Program Meeting, Boston, 13 May 1980
(Contract EY-76-C-04-0789)
(SAND-80-0379C; CONF-800504) Avail: NTIS HC A02/MF A01

Developments in the area of high temperature active semiconductor devices for use at 275 C in instrumentation needed to characterize geothermal resources are described. Surveys of silicon bipolar, MOS, and JFET devices operated at high temperature and development work on high temperature silicon CMOS logic and DI analog circuits are reviewed. The initial results of development work on GaAs and GaP diodes are discussed. These efforts have identified several promising devices for high temperature applications, however, further development is required to resolve such problems as excessive leakage currents, metalization degradation, device stability, and long term aging. DOE

N80-26609# California Univ., Livermore. Lawrence Livermore Lab. Electronic Engineering Dept.
THE STANDING WAVE METHOD OF DETERMINING THE RESONANT FREQUENCY OF CIRCUITS INVOLVING LOW L AND HIGH C
H. Graham 13 Mar. 1980 11 p
(Contract W-7405-eng-48)
(UCID-18580) Avail: NTIS HC A02/MF A01

A method is described which is capable of determining the resonant frequency of L C circuits involving inductances as low as .001 uH and net impedances as low as .001 ohm, provided the resonant frequency is below 15 mc. External circuitry does not effect the accuracy of measurement as this circuitry is not included in the parameters of the circuit being measured. It is possible to determine the effective resistance of the circuit being measured and thereby obtain the efficiency of the system. DOE

N80-26610# Bendix Corp., Kansas City, Mo.
CONTROL OF ELECTROSTATIC DAMAGE TO ELECTRONIC CIRCUITS
Whitson J. Kirk, Jr. Mar. 1980 21 p refs Presented at the 6th Ann. Reliability Testing Inst., Tucson, Ariz., 14-18 Apr. 1980
(Contract EY-76-C-04-0613)
(BDX-613-2428; CONF-800440-1) Avail: NTIS HC A02/MF A01

The static voltages generated by movements degrade or destroy many solid state devices currently used in sophisticated electronic equipment. Discharge of static voltages through these sensitive devices during assembly operations lead to a nonfunctional assembly fabricated from parts which previously were acceptable or to later failure of an assembly which was functional after fabrication. Sources of electrostatic charges, equipment and methods for minimizing the generation of electrostatic voltages during the production, assembly and packaging of solid state electronic equipment, and the sensitivity of solid state devices to electrostatic damage are discussed. Static awareness is the key to an effective electrostatic damage (ESD) control program. Production facilities must incorporate electrostatic protection facilities, materials, and processes so that workers can concentrate on producing a high quality product without having to be overly concerned about ESD procedures. DOE

N80-26611# Mission Research Corp., Albuquerque, N. Mex.
TRANSIENT EFFECTS FROM LIGHTNING. VOLUME 1: TRANSIENT ELECTROMAGNETIC FIELDS FROM LIGHTNING DISCHARGES
H. Fowles, L. Scott, and J. Hamm Jan. 1980 184 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7051-Vol-1) Avail: NTIS HC A09/MF A01

The effects of lightning on solar photovoltaic systems in the 100 kilowatt to 1 megawatt power range, and methods for protecting these systems from lightning are discussed. The statistics of lightning strokes is reviewed, and the model which predicts the electromagnetic fields and optical power density is summarized. Coupling of the electromagnetic fields to photovoltaic system elements is also discussed, and the experience of power and telephone companies with lightning transients is drawn upon. A theoretical model for predicting damage thresholds for modern terrestrial solar cells is presented. The thresholds are presented in the form of peak currents as a function of pulse width for two separate failure modes: melting of the deposited metal grid and burnout of the junction. Lightning protection techniques which are technically and economically feasible for photovoltaic systems are discussed. The techniques of shielding and terminal protection are discussed. DOE

N80-26612# National Physical Lab., Teddington (England). Div. of Electrical Science.
THE LOCATION OF REFLECTIONS IN TWO-PORT MICROWAVE COMPONENTS
A. E. Fantom Nov. 1979 42 p refs
(NPL-DES-61) Avail: NTIS HC A03/MF A01

The location of reflections in microwave components is discussed with particular regard to two port devices. It is shown that the extra information which can be obtained when both ports are accessible can be used to distinguish between lossy and lossless reflexions. An instrument is proposed (the locating absorptometer) based on this fact. Two versions of the instrument are investigated; one using an analog method of obtaining the Fourier transform, the other using a computer to perform the transform. Qualitative results were obtained with the analog version. The computer version was tested with known sources of reflection having reflection coefficients between 0.15 and 0.42 and gave agreement within 0.04. Author (ESA)

N80-26613# European Space Agency, Paris (France).
THEORETICAL EVALUATION OF A GROUNDING CONFIGURATION FOR AN INDIUM-OXIDE-COATED THERMAL-CONTROL MATERIAL
S. J. Bosma (ESTEC, Noordwijk, Netherlands) Jan. 1980 22 p refs
(ESA-STM-212) Avail: NTIS HC A02/MF A01

The electrical grounding of thermal control materials coated with indium oxide was investigated using a theoretical evaluation. It is shown that the application of basic circular grounding point is an adequate method of grounding for thermal control sheets of any size or shape. The method reduces labor and material costs and leads to only small losses of optical performance. Author (ESA)

N80-26614# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbeiter.
DEVELOPMENTS OF HIGH COMPLEXITY LINEAR INTEGRATED CIRCUITS Final Report
Bernd Eichler Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 60 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-36) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 12,20

Requirements for an economical production of linear integrated bipolar circuits of high complexity are described. The results of this study were used to develop several complex integrated circuits using specific optimization techniques. Typical examples explain measurement techniques used with these circuits. Two concepts for PAL decoders with four and three integrated circuits are described. Author (ESA)

N80-26615# AEG-Telefunken, Heilbronn (West Germany). Fachbereich Halbleiter.
DEVELOPMENT OF TECHNICAL INTEGRATED CIRCUITS Final Report
Ingo Hagenloch Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 51 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-41) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 10,30

The results of integrated circuit development studies are reported. The following circuits are described: (1) two touch switches for mode and channel setting on radio and television receivers; (2) a phase control and a zero crossing switch to drive SCRs or Triacs; (3) a directional and a warning circuit for motor vehicles; (4) an automotive seat belt interlock system; (5) a timer for electronic watches; and (6) a light dimmer with touch control. Author (ESA)

N80-26616# Siemens A.G., Erlangen (West Germany). Forschungslab.
SUPPLEMENTARY INVESTIGATIONS FO FUNDAMENTAL RESEARCH PROGRAM PLASMA TECHNIQUES Final Report
Walter Hertz, Juergen Mentel, Harald Motschmann, and Wilhelm

Tiemann Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 192 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-43) Avail: NTIS HC A09/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 40

The flow of SF6 in a double nozzle circuit breaker model with and without arc is investigated through the use of holographic systems. The gas flow interferograms are evaluated and a program is developed to calculate the gas density and velocity for adiabatic flow. The ac discharges in SF6 gas flows are investigated for a double nozzle circuit breaker. Author (ESA)

N80-26617# AEG-Telefunken, Ulm (West Germany). Forschungsinst.
SEMICONDUCTOR CROSSPOINTS FOR DIRECT REPLACEMENT OF ELECTROMECHANICAL SWITCHES WITH HIGH VOLTAGE REQUIREMENTS Final Report
Erich Baechle, Reinhard Becker, Helmut Knapp, Max Kulsi, Friedrich Laemmel, Bernhard Rall, Klaus Schlueter, and Hans Schuessler Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 166 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-44) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 34.45

Specifications for solid state switches were developed based on studies of telephone exchange systems. It was found that a sufficiently high breakdown voltage coupled with a low resistance when the switch is closed are difficult to achieve. Hybrid integration with thick film technology led to solutions for crosspoint elements which were found to be only marginally cost effective. Alternative solutions are proposed. Author (ESA)

N80-26618# Brown, Boveri und Cie. A.G., Heidelberg (West Germany). Zentrales Forschungslab.
PASSIVATION OF SILICON POWER DEVICES BY THERMAL OXIDATION Final Report
Arno Naidig, Georg Wahl, Klaus Waimann, and Gabriele Gilbers Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 77 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-48) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 16

A method was developed for the passivation of high voltage silicon power devices which opens the way for low cost packaging of high voltage power devices. Thermal oxidation at temperatures between 600 C and 900 C is used followed by chemical vapor deposition of a barrier larger against alkaline impurities. Author (ESA)

N80-26619# Siemens A.G., Munich (West Germany). Unternehmungsbereich Bauelemente.
INTEGRATED CIRCUITS FOR REMOTE COMMAND AND DATA TRANSMISSION Final Report
Eckart Schatter Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 26 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-50) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 5.05

A universal system for command transmission was developed using as a starting point remote control techniques for television receivers. The system uses an infrared light carrier and features extremely high noise protection together with a wide action range. A digital transmitter and a receiver integrated circuit as well as a bipolar high-gain preamplifier were developed for this application. Author (ESA)

N80-26620# Danish Research Center for Applied Electronics, Hoersholm.
CHARACTERIZATION OF RANDOM ACCESS MEMORIES: STRATEGIES, TEST PATTERNS AND PARAMETERS INVOLVED IN THE CHARACTERIZATION OF RAM MEMORIES AND AN EVALUATION OF 16 k RAM'S OF EIGHT MANUFACTURES
Eskild Jensen and Birger Schneider Nov. 1979 55 p refs
(ECR-93) Avail: NTIS HC A04/MF A01

Techniques for the testing and characterization of dynamic random access memories (RAM's) are described. The general background of RAM operations and related failure modes are discussed. This includes descriptions of typical RAM sensitivities due to supply voltage variations, supply voltage interactions, extreme temperatures, test patterns, operational modes, and timing conditions. An operating region can be defined for each device under test. In addition it is shown how the characterization will result in worst case test conditions for use in production testing. A characterization of eight manufactures of industry standard 16 k x 1 bit dynamic RAMS's is carried out and the sensitivities revealed are described and commented on. Author (ESA)

N80-26351*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A THEORETICAL MODEL OF PHASE CHANGES OF A KLYSTRON DUE TO VARIATION OF OPERATING PARAMETERS
A. Kupiszewski *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 62-64 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

N80-26353*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH-POWER TRANSMITTER AUTOMATION
R. Gosline *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 71-81 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

N80-26559# Physics Lab. RVO-TNO, The Hague (Netherlands).
A SURVEY OF PROPERTIES OF LATCHED NON RECIPROCAL FERRITE PHASE SHIFTERS WITH CYLINDRICAL RODS AT 3, 5.5, 9.3 AND 16 GHz
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 6 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26560# Physics Lab. RVO-TNO, The Hague (Netherlands).
PERFORMANCE OF FERRITE AND DIODE PHASE SHIFTERS AT MILLIMETER WAVELENGTHS
J. Sneider *In its* On Microwave Meas., Transmission and Reception Dec. 1978 21 p (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26561# Physics Lab. RVO-TNO, The Hague (Netherlands).
MICROSTRIP DIODE PHASE SHIFTERS FOR S-BAND AND C-BAND
W. P. M. N. Keizer *In its* On Microwave Meas., Transmission and Reception Dec. 1978 8 p (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

N80-26562# Physics Lab. RVO-TNO, The Hague (Netherlands).
COMPARISON BETWEEN FERRITE AND DIODE PHASE SHIFTERS TO BE USED IN PHASED-ARRAY ANTENNAS
J. Sneider and W. P. M. N. Keizer *In its* On Microwave Meas., Transmission and Reception Dec. 1978 9 p refs (For primary document see N80-26551 17-31)
Avail: NTIS HC A07/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N80-26621*# Systems and Applied Sciences Corp., Hampton, Va.
TRANSITION PREDICTION USING THREE DIMENSIONAL STABILITY ANALYSIS
Mujeeb R. Malik Jun. 1980 31 p refs
(Contract NAS1-15604)
(NASA-CR-159277; R-SAL-6/80-01) Avail: NTIS

HC A03/MF A01 CSCL 20D

Several methods of transition prediction by linear stability analysis are compared. The spectral stability analysis code SALLY is used to analyze flows over laminar flow control wings. It is shown that transition by the envelope method and a new modified wave packet method are comparable in reliability but that the envelope method is more efficient computationally. Author

N80-28622*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NOISE REDUCTION IN A MACH 5 WIND TUNNEL WITH A RECTANGULAR ROD-WALL SOUND SHIELD

Theodore R. Creel, Jr., J. Wayne Keyes, and Ivan E. Beckwith Jun. 1980 82 p refs

(NASA-TP-1672; L-13451) Avail: NTIS HC A05/MF A01 CSCL 20D

A rod wall sound shield was tested over a range of Reynolds numbers of 0.5 x 10 to the 7th power to 8.0 x 10 to the 7th power per meter. The model consisted of a rectangular array of longitudinal rods with boundary-layer suction through gaps between the rods. Suitable measurement techniques were used to determine properties of the flow and acoustic disturbance in the shield and transition in the rod boundary layers. Measurements indicated that for a Reynolds number of 1.5 x 10 to the 9th power the noise in the shielded region was significantly reduced, but only when the flow is mostly laminar on the rods. Actual nozzle input noise measured on the nozzle centerline before reflection at the shield walls was attenuated only slightly even when the rod boundary layer were laminar. At a lower Reynolds number, nozzle input noise at noise levels in the shield were still too high for application to a quiet tunnel. At Reynolds numbers above 2.0 x 10 the the 7th power per meter, measured noise levels were generally higher than nozzle input levels, probably due to transition in the rod boundary layers. The small attenuation of nozzle input noise at intermediate Reynolds numbers for laminar rod layers at the acoustic origins is apparently due to high frequencies of noise. Author

N80-28623# TRW Defense and Space Systems Group, Redondo Beach, Calif.

DEVELOPMENT STUDY OF A TWO-STAGE CONTINUOUS FLOW IMPACTOR Final Report

Nahum Gat Aberdeen Proving Ground, Md. ARRACOM Mar. 1980 89 p refs

(Contract DAAK11-78-C-0103)

(AD-A083387; AD-E410241; TRW-33437-6001-RU-00; ARCSL-CR-80009) Avail: NTIS HC A05/MF A01 CSCL 14/2

Two units of a Continuous Flow Impactor (CI) were designed, constructed and tested. The units have been calibrated using DOP droplets and their fractionation points are approximately 4 and 1 micrometers for the first and second units respectively. The principal design criteria established in previous studies have been verified, and reshaping the collection chambers has proven effective in improving performance. The steepness of the cross-over efficiency of the 1st unit is comparable to that of other commercially available impactors. The performance of the 2nd unit is not as good though; this is attributed to high particle loss in that unit. The two units have been operated in a cascade arrangement which separates an airborne (window) of a desired particle size range - between the fractionation points of the two stages - out of a polydispersed aerosol. The particle loss mechanisms are discussed and improvements are suggested to reduce the loss. Other potential applications of the CI such as in the separation of monodispersed aerosols, density measurement of spherical particles and shape factor determination are discussed as well. GRA

N80-28624# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.

AN INTEGRAL METHOD AND ITS APPLICATION TO SOME THREE-DIMENSIONAL BOUNDARY-LAYER FLOWS

T. F. Zien 18 Jul. 1979 68 p refs Sponsored by Navy (zr0140201)

(AD-A083447; NSWC/TR-79-139) Avail: NTIS HC A04/MF A01 CSCL 20/4

The simple integral method developed and successfully employed by the author to provide accurate approximate solutions to a wide variety of problems in viscous boundary-layer flows and transient heat conduction with phase changes is further studied. A simple boundary value problem in ordinary differential equation is used as the model problem for the study. Different schemes of the method used in earlier applications are examined in some detail along with a new and potentially more accurate scheme. On the basis of the comparison between the approximate solutions and the exact solution, some remarks on the relative merits of the various schemes are made along with some observations on the judicious choice of the approximate profiles for use in the calculation. The method is then applied to yield approximate solutions of a class of relatively simple three-dimensional boundary-layer flows. Results are reported of boundary layers on a semi-infinite flat plate with parabolic and circular inviscid surface streamlines, and boundary layers over an infinite yawed wing. Results are presented in terms of skin-friction, and are all obtained in simple closed form. Comparisons with existing exact solutions are included to indicate the accuracy of the method. GRA

N80-28625# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistic Research Lab.

NUMERICAL CALCULATION OF THREE-DIMENSIONAL DISPLACEMENT EFFECT ON BODIES OF REVOLUTION Final Report

Robert P. Reklis Feb. 1980 24 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A083296; AD-E430402; ARBRL-MR-02993) Avail: NTIS HC A02/MF A01 CSCL 20/4

Moore's differential equation for the three dimensional displacement thickness is solved numerically for bodies of revolution. Comparison is made to a known analytic solution for the special case of a cone in supersonic flow. Results are presented for spinning and non-spinning artillery projectile shapes. GRA

N80-28626# Los Alamos Scientific Lab., N. Mex.

NUMERICAL STUDY OF CONDENSATION IN CONCURRENT STRATIFIED FLOWS

B. J. Daly and F. H. Harlow Feb. 1980 28 p refs

(Contract W-7405-eng-36)

(NUREG-CR-1108; LA-8077) Avail: NTIS HC A03/MF A01

A mathematical model of mass, momentum, and energy exchange in two phase, separated flow is described, with application to the study of condensation processes in concurrent, horizontally stratified, steam water flow. Steady state numerical solutions are obtained for a variety of steam and water inflow conditions and are compared with experimental measurements. Analysis of these results provides insight regarding the interrelationship of the various processes that influence condensation. DOE

N80-28627# Science Applications, Inc., La Jolla, Calif.

STATE-OF-THE-ART ASSESSMENT OF HYBRID HEAT PUMPS Final Report

M. H. Blatt and R. C. Erickson Dec. 1979 171 p refs

(EPRI Proj. 1201-6)

(EPRI-EM-1261) Avail: NTIS HC A08/MF A01

The hybrid heat pump is evaluated and is compared with other heating, ventilating, and air conditioning (HVAC) system options. A hybrid heat pump is an HVAC system which includes an electrically driven heat pump and supplementally fired gas or oil boiler. This system was compared with heat pumps, oil-fired boilers, and gas-fired boilers. DOE

N80-28628# Argonne National Lab., Ill. Chemistry Div.

REVERSE ABSORPTION MODE OF THE HYCSOS CHEMICAL HEAT PUMP WITH LOW GRADE (APPROXIMATELY 30 DEG C) THERMAL ENERGY INPUTS

D. M. Gruen, M. Mendelsohn, I. Sheft, and G. Lamich 1980 23 p refs Presented at the Workshop on Thermochem. Energy Storage, Stockholm, 7-9 Jan. 1980; sponsored by the Swedish Royal Academy of Engineering Sciences

(Contract W-7405-eng-38)

(CONF-800133-1) Avail: NTIS HC A02/MF A01

An efficient and cost competitive chemical heat pump and energy conversion system driven by solar, and by fossil fuels (gas or oil), are discussed. The HYCOS concept uses two different

metal hydrides with different free energies of formation enabling hydrogen to flow from one to another of the hydrides under the influence of appropriate thermal gradients. In the chemical heat pump mode, hydrogen flows between two pairs of four vessels which take the place of the generator condenser and evaporator absorber elements of conventional absorption refrigerators. The functions of generator absorber and condenser evaporator are interchanged at the end of each two minute cycle. The chemical heat pump materials are based on the AB5 alloys which combine a remarkable ability to absorp hydrogen rapidly and reversibly at moderate pressures near ambient temperature with a large hydrogen storage capacity. DOE

N80-26629# Oregon State Univ., Corvallis. School of Oceanography.
MESOSCALE STUDIES OF FLOW REGIMES AND FLUXES OF PARTICULATE MATTER IN COASTAL WATERS Annual Progress Report, 1 Apr. 1979 - 31 Mar. 1980
David M. Nelson, Hasong Pak, Lawrence F. Small, and J. Ronald V. Zaneveld Mar. 1980 44 p refs
(Contract EY-76-S-06-2227)
(RLO-2227/T29-10) Avail: NTIS HC A03/MF A01

Suspended particle distributions and dynamics provide a tremendous collective surface area for adsorption and absorption of materials directly or indirectly involved with the production and distribution of energy reserves. The following subject areas are included: (1) seasonal effects on the distributions and movements of suspended particulate matter (spm) in a near coast region of smooth bathymetry; (2) summer effects on the distribution and movement of spm in a submarine canyon; (3) development of a numerical model of time space distribution of spm in a near coast region of smooth bathymetry; (4) fractionation of spm into organic and inorganic fractions; (5) identification of sources, sinks, and fluxes of different compartments of the spm; and (6) development of in situ instrument packages. DOE

N80-26630# Admiralty Underwater Weapons Establishment, Portland (England).
A MATHEMATICAL MODEL OF WATER ENTRY
A. M. Mackay London HMSO Oct. 1979 51 p refs
(AUWE-TN-636/79) Avail: NTIS HC A04/MF A01

A computer simulation of the water entry of an axisymmetric body with or without a cruciform tail and with or without a parachute delivery system is described. The predictions of the simulation are shown to agree with experimental observations of water entry motion. The FORTRAN program which implements this model is listed. Over the range of impact velocities (20 to 40 m/sec) which were experimentally investigated using a full scale dummy torpedo, the simulation gave reasonable agreement with the measured water entry behavior. Author (ESA)

N80-26631# National Engineering Lab., East Kilbride (Scotland). Flow Measurement Div.
FLOW MEASUREMENT IN SWIRLING OR ASYMMETRIC FLOW
F. C. Kinghorn May 1979 27 p refs Presented at The Appl. of Flow Measuring Tech. Symp., Brighton, England, Apr. 1977
(NEL-663) Avail: NTIS HC A03/MF A01

Information on the use of pressure difference flowmeters and traverse methods in poor flow conditions are summarized and alternative approaches to being able to achieve accuracies of the order of two or three percent under such conditions are described. Particular attention is given to the use of flow straighteners of various types. The effects of a few particular bends on orifice plates are defined. Author (ESA)

N80-26632# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.
INVESTIGATION OF TRANSONIC STEAM TURBINE TIP SECTIONS WITH VARIOUS SUCTION SIDE BLADE CURVATURES
C. C. H. Sieverding, R. Decuypere (Ecole Roy. Mil.), and P. Hautot Dec. 1978 35 p refs Presented at Inst. of Mech. Engr. Design Conf. on Steam Turbines for the 1980's, London, Oct. 1979 Submitted for publication
(VKI-Preprint-1979-2) Avail: NTIS HC A03/MF A01

Theoretical and experimental results from studies of three transonic steam turbine rotor tip sections are presented. The aim is to evaluate the effect of various suction side curvatures on the blade performance at both design and off-design conditions. The experiments were conducted in a high speed cascade tunnel in the outlet Mach number range 0.8 to 1.7 with air as the working medium. The experiments included flow visualization tests using Schlieren photographs, detailed blade pressure distribution measurements, and blade performance measurements. The experimental blade velocity distributions and the outlet flow angles are compared with theoretical predictions obtained with a time marching method. Results confirm the usefulness of this time dependent finite area method in predicting performance of transonic blades. It is shown that any improvement of the design point performance by careful shaping of the suction side results in considerable reduction of the operating range. Author (ESA)

N80-26633# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A NUMERICAL ESTIMATION OF THE ERROR ON THE INDUCED VELOCITY DUE TO A DISCRETE APPROXIMATION OF A TWO-DIMENSIONAL VORTEX SHEET
A. Turi Jun. 1979 28 p refs
(VKI-TN-131) Avail: NTIS HC A03/MF A01

A two dimensional infinite vortex sheet of the Prandtl type is considered, having along its finite width the same vorticity distribution as from the trailing edge of a symmetrically loaded wing. Four types of discretization are analyzed reproducing the vortex sheet by making use of singularities. The first and second models represent the sheet by discrete vortices, while a piecewise continuous vorticity distribution is posed by the other two models. The error analysis is based on the evaluation of the velocity induced by the discretized vorticity distribution at a certain number of points along a segment of vorticity identified with a normal section of the sheet itself. The velocities induced by each model of discretization are then compared with the corresponding exact values given by an analytical formula. The error is computed as a function of the number of singularities, discrete or continuous, used by each to reproduce the actual vortex sheet.Author (ESA)

N80-26634# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Environmental and Applied Fluid Dynamics Dept.
COMPARISON OF SOME FINITE DIFFERENCE METHODS FOR THE PREDICTION OF HEAT TRANSFER PHENOMENA IN A POROUS, HEAT PRODUCING MEDIUM
C. Benocci and J-M. Buchlin Sep. 1979 46 p refs Prepared in cooperation with Centre d'Etude de l'Energie Nucleaire, Mol, Belguim
(VKI-TN-133) Avail: NTIS HC A03/MF A01

The testing of some advanced finite difference techniques for the prediction of natural convection in a porous, heat producing medium saturated by a liquid layer is discussed. This requires the solutions be of a set of nonlinear partial differential equations. Various step splitting methods are applied. Essentially, these are the 'alternate direction explicit and the alternate direction implicit methods. results are compared and discussed. It is shown that the explicit method is too slow for practical application, while alternate direction implicit techniques offer acceptable results. Thus, heat transfer phenomenology in packed beds is amenable to successful numerical study with reasonale machine times. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-26635* National Aeronautics and Space Administration. Pasadena Office, Calif.
COOLED ECHELLE GRATING SPECTROMETER Patent

Reinhard Beer, inventor (to NASA) (JPL) Issued 27 May 1980 6 p Continuation of abandoned US Patent Appl. SN-646333, filed 2 Jan. 1976 Sponsored by NASA
(NASA-Case-NPO-14372-1; US-Patent-4,205,229; US-Patent-Appl-SN-956529; US-Patent-Class-250-352; US-Patent-Class-250-338; US-Patent-Class-250-353; US-Patent-Class-356-328; US-Patent-Appl-SN-646333) Avail: US Patent and Trademark Office CSCL 14B

A cooled echelle grating spectrometer for detecting wavelengths between one micron and fifteen microns is disclosed. More specifically, the spectrometer has a cross-dispersing grating for ordering infrared energy and an echelle grating for further ordering of the infrared energy. Ordered radiation from the echelle grating is sensed by a detecting means. Also disclosed is use of a Schmidt camera for focusing the further ordered radiation from the echelle grating onto a detector array having individual detectors dispersed on a plane which substantially corresponds to a curved focal plane of the Schmidt camera. A spectrometer constructed according to the teachings of the present invention will continuously cover the spectrum between one micron and fifteen microns and have a resolution of 0.1/cm.

Official Gazette of the U.S. Patent and Trademark Office

N80-26636 Naval Aircraft Materials Lab., Fleetlands (England).
EVALUATION OF THE USE OF MONO-SIZE SPHERES FOR CALIBRATING AUTOMATIC PARTICLE COUNTERS
C. C. Bird, D. J. Byng, and D. Maundrell 3 Jan. 1978 17 p refs
(BR60651) Avail: Issuing Activity

A method for calibrating sensor heads of automatic particle counters (APCs) was evaluated. The technique relies on the use of mono-sized spheres suspended in a liquid medium. The evaluation shows that the method can be readily applied to APCs utilizing the light blockage principle and suggests certain advantages of the technique over existing methods. The use of mono-sized spheres is recommended as a suitable alternative to present calibration techniques. Author (ESA)

N80-26637*# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOFT X-RAY POLYCHROMATOR FOR THE SOLAR MAXIMUM MISSION Final Report
C. W. Gilbreth, C. W. Acton, and C. J. Wolfson Apr. 1980 37 p refs
(Contract NAS5-23758)
(NASA-CR-159994) Avail: NTIS HC A03/MF A01 CSCL 14B

The design, fabrication, development tests, integration, and acceptance tests of the X-ray polychromator are reported. Spacecraft integration and test support, orbital operations preparations, and launch and post launch operations support tasks are discussed. B.D.

N80-26638*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
A 94/183 GHz AIRCRAFT RADIOMETER SYSTEM FOR PROJECT STORM FURY Final Technical Report, 20 Sep. 1976 - 20 Apr. 1980
J. A. Gagliano, J. A. Stratigos, R. E. Forsythe, J. M. Schuchardt, J. M. Welch, and D. O. Gallentine Apr. 1980 96 p
(Contract NAS5-23710)
(NASA-CR-160000) Avail: NTIS HC A05/MF A01 CSCL 14B

A radiometer design suitable for use in NASA's WB-57F aircraft to collect data from severe storm regions was developed. The design recommended was a 94/183 GHz scanning radiometer with 3 IF channels on either side of the 183.3 GHz water vapor line and a single IF channel for a low loss atmospheric window channel at 94 GHz. The development and construction of the 94/183 GHz scanning radiometer known as the Advanced Microwave Moisture Sounder (AMMS) is presented. The radiometer scans the scene below the aircraft over an angle of + or - 45 degrees with the beamwidth of the scene viewed of approximately 2 degrees at 94 GHz and 1 degree at 183 GHz. The AMMS data collection system consists of a microcomputer used to store the radiometer data on the flight cartridge recorder, operate the stepper motor driven scanner, and collect housekeeping data such as thermistor temperature readings and aircraft time code. B.D.

N80-26639*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PRELIMINARY DESIGN OF THE CRYOGENIC COOLED LIMB SCANNING INTERFEROMETER RADIOMETER (CLIR), PHASE 2 Final Report
20 Jan. 1978 45 p
(Contract NAS5-25320)
(NASA-CR-159992; LMSC-D633472) Avail: NTIS HC A03/MF A01 CSCL 14B

A cryogenic system to be utilized with a mounted pointing system is designed. The analysis indicates that the resulting design is significantly heavier than previous design due to the increased diameter of the system, resulting in greater tank and vacuum enclosure weights. Additional weight is also required in the area where the payload is attached to the pointing system in order to provide additional stiffness to the payload. The vacuum shell required to enclose the instrument is shorter and therefore an attendant reduction in instrument package weight would be expected. The primary resonance of the cooler instrument package occurs at 21 Hz, a mode in which the flexibility of the vacuum shell allows motion of the cryogen tank and instrument, and which can be increased by additional stiffening in the region of the pointing system vacuum shell connection at the cost of additional weight. The second resonance at 59 Hz is due to vibration of the helium tank on the fiberglass support tubes. The parasitic heat load can be reduced to 0.28 W by the utilization of a sandwich support tube structure in place of the monocoque structure assumed in the design. E.D.K.

N80-26640# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
AN OSCILLATORY MASS FLOWMETER FOR GAS-LIQUID FLOWS
L. M. Druzhkova, V. G. Bulygin, V. E. Egorov, V. S. Nesterenko, and A. L. Lavrov-Averin 1980 9 p refs Transl. into ENGLISH from Pribory i sistemy upravleniya (USSR), no. 11, 1972 p 22-24
(NRC/CNR-TT-1967; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

An oscillatory flowmeter (BMP-1) designed to measure the mass flow of gas liquid mixtures without the prior separation of the liquid was developed. The flowmeter consists of a BMP-1 sensing device and a decrameter. The sensing device includes a mechanical pendulum, an output sensor, and a driver unit. The electromagnets of the driver unit receive cyclic signals, when transmitting stops the pendulum freely oscillates in a transverse direction. The fluid whose flow rate is to be measured flows through the central passage of the pendulum, so as to dampen the pendulum oscillations. The coefficient of attenuation of the pendulum oscillations is proportional to the fluid mass flow G which is to be metered. A numerical evaluation of the effect of the structural dimensions of the sensing unit on its output performance is conducted. E.D.K.

N80-26641*# Harris Corp., Melbourne, Fla.
OPTICAL MASS MEMORY INVESTIGATION Final Report
2 May 1980 123 p
(Contract NAS8-30564)
(NASA-CR-161489) Avail: NTIS HC A06/MF A01 CSCL 14B

The MASTER 1 optical mass storage system advanced working model (AWM) was designed to demonstrate recording and playback of imagery data and to enable quantitative data to be derived as to the statistical distribution of raw errors experienced through the system. The AWM consists of two subsystems, the recorder and storage and retrieval. The recorder subsystem utilizes key technologies such as an acoustic travelling wave lens to achieve recording of digital data on fiche at a rate of 30 Mbits/sec, whereas the storage and retrieval reproducer subsystem utilizes a less complex optical system that employs an acousto-optical beam deflector to achieve data readout at a 5 Mbits/sec rate. The system has the built in capability for detecting and collecting error statistics. The recorder and storage and retrieval subsystems operate independent of one another and are each constructed in modular form with each module

performing independent functions. The operation of each module and its interface to other modules is controlled by one controller for both subsystems. E.D.K.

N80-26642*# National Aeronautics and Space Administration, Washington, D. C.
DEVELOPMENT OF A FEED MONITOR SYSTEM FOR A HELIUM-COOLED MICHELSON INTERFEROMETER FOR THE SPACELAB
P. Essenwanger Jun. 1980 75 p Transl. into ENGLISH of 'Entwicklung eines Vorschubmesssystems fuer ein Helium-Gekuehltes Michelsoninterferometer auf spacelab', Rept. MPI-PAE/Extraterr.-161, Max-Planck Inst. fuer Phys. und Astrophys., Inst. for Extraterrestrial Physics., Munich, Jan. 1980 p 1-85 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76275; MPI-PAE/Extraterr-161) Avail: NTIS HC A04/MF A01 CSCL 14B

A Michelson interferometer feed monitor system developed for Spacelab is described. The device is helium cooled and is to be used to measure far infrared radiation sources in space. Performance data and development sequence are presented. Author

N80-26643# Philips Labs., Briarcliff Manor, New York.
DEVELOPMENT OF AN ELECTROPHORETIC IMAGE DISPLAY Quarterly Technical Report, 1 Aug. - 31 Oct. 1979
Richard Liebert and Joseph Lalak Nov. 1979 17 p ref
(Contracts MDA903-79-C-0439; DARPA Order 3802)
(AD-A083489; QTR-1) Avail: NTIS HC A02/MF A01 CSCL 14/2

The purpose of this work is to develop a 350 x 600 element X-Y addressed electrophoretic image display (EPID). The design and fabrication of a control-grid electrode supported by a Mylar dielectric has been investigated. Computer modeling is being used as a design aid, and ion-beam milling has been successfully used to fabricate the Mylar control-grid electrode. The Mylar dielectric is attached to the In2O3 coated substrate using heat and pressure alone or in combination with an epoxy adhesion promoter. Good seals, with occasional nonbonded areas, were obtained by heating the Mylar while applying pressure. Better seals were obtained when one side of the Mylar was coated with epoxy. Operating life-test results indicate no adverse interactions between the electrophoretic suspension and the Mylar/epoxy seal. Computer modeling of the electrostatic potential in the device is in progress. GRA

N80-26644# Philips Labs., Briarcliff Manor, New York.
DEVELOPMENT OF AN ELECTROPHORETIC IMAGE DISPLAY Quarterly Technical Report, 1 Nov. 1979 - 31 Jan. 1980
Richard Liebert and Joseph Lalak Mar. 1980 25 p refs
(Contracts MDA903-79-c-0439; DARPA Order 3802)
(AD-A083490) Avail: NTIS HC A02/MF A01 CSCL 14/2

The size of the ion-beam milled control-grid structure was increased to 2.0 in. x 2.6 in. (from 0.75 in. x 0.75 in.); the diameter of the uniform area is 2.7 in. Fabrication techniques for this larger size are being developed. The design of a working display is nearly complete. Using the results of the computer model, the dimensions of the display were chosen. The potential wells will be 30 micrometers x 102 micrometers with 6 micrometers wide walls. The maximum separation between electrodes will be 62 micrometers, and the walls with be 12 micrometers deep. The display will have 16 rows of 32 characters in a 5 x 7 dot matrix font with a resolution of 2 1p/mm. The active area will be 2.22 in. x 1.43. in and contain 32,224 pixels. It was decided to use In2O3 as the material for the grid electrode instead of aluminum; deposition of the In2O3 will begin as soon as the sputtering system is modified. GRA

N80-26645# Los Alamos Scientific Lab., N. Mex.
APPLICATIONS OF DIGITAL IMAGE RESTORATION TO PHOTOGRAPHIC EVIDENCE
H. J. Trussell and T. M. Cannon 1980 6 p refs Presented at the Conf. on Crime Countermeas., Lexington, Ky., 14-16 May 1980
(Contract W-7405-eng-36)
(LA-UR-80-399; CONF-800512-1) Avail: NTIS HC A02/MF A01

A review of the cepstral method of blur determination for motion blur and out-of-focus lens is given. A review of the maximum a posteriori restoration method is given. The reasons why this method produces few artifacts are discussed. Results of the complete image restoration process are given. DOE

N80-26646# Sandia Labs., Albuquerque, N. Mex. Exploratory Chemistry Div.
AUTOMATION OF A REPETITIVE EXPERIMENT APPLIED TO A THERMOGRAVIMETRIC ANALYZER
Keith Burris Mar. 1980 15 p
(Contract EY-76-C-04-0789)
(SAND-80-8010) Avail: NTIS HC A02/MF A01

In order to automate the recording of data from a thermogravimetric analyzer, a controller was designed to fetch instrument readings at specified time intervals and send the data to a teletype/paper tape punch. Additional goals were to minimize cost, hardware design time, software development time, and debugging time. Project details which can be applied to a general class of repetitive experiments that are common in a laboratory environment are described. DOE

N80-26647# National Physical Lab., Teddington (England). Dept. of Electrical Science.
A LARGE APERTURE CALORIMETER FOR FUSION LASER MEASUREMENTS
J. G. Edwards and P. A. Smith Sep. 1979 13 p refs
(NPL-DES-S7) Avail: NTIS HC A02/MF A01

A large aperture calorimeter intended for laser fusion measurements on beams up to 20 cm diameter was constructed. The laser beam is absorbed in a glass disc backed by a disc carrying a resistance wire. It performs with a noise equivalent energy of 20 mJ and a maximum energy of about 100 J, but difficulties encountered in construction caused a 17% variation of sensitivity across the aperture. Author (ESA)

N80-26648# National Physical Lab., Teddington (England). Div. of Electrical Science.
COIL-MEASURING MACHINE
P. Vigoureux Dec. 1979 24 p refs
(NPL-DES-S8) Avail: NTIS HC A02/MF A01

A machine was constructed to measure the diameters and axial positions of the turns of single layer coils used for realizing or monitoring electric units. The diameters are referred to a length standard previously measured in terms of the meter, but the axial positions are measured directly by an interferometer forming part of the machine. All results are punched on tape, and the desired property of the coil is solved by computer. Author (ESA)

N80-26649# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
DEVELOPMENT AND CALIBRATION OF A TOTAL TEMPERATURE PROBE FOR THE IMPERIAL COLLEGE AERONAUTICS DEPARTMENT GUN TUNNEL
R. P. Bartlett, A. J. Edwards, and R. Hillier Jun. 1979 32 p refs
(Contract AT/2037/084)
(IC-Aero-79-02) Avail: NTIS HC A03/MF A01

Development of a vented-shield thermocouple probe for total temperature measurements in a hypersonic turbulent boundary layer concentrated on maximizing both the transient response rates and the steady state recovery factor (which eventually reached about 98% at the highest test Reynolds numbers) is described. This performance was achieved by maximizing the unit Reynolds number within the shield and hence the convective heating of the sensor; and by improving the sensor aspect ratio parameters which control the conduction losses. The probe was operated with an unheated shield. It is argued that shielding a probe affords aerodynamic and response advantages compared with its unshielded counterpart. Performance deteriorates with reduction in Reynolds number and hence with immersion in the boundary layer. The critical limit in a short duration facility must always be failure to reach a steady state. Probes were calibrated against Reynolds number for the required range but at fixed total temperature. It is expected

that the worst error in steady state temperature for a given probe would be of order 40 K with a considerable improvement in overall accuracy for profile data averaged from several probes. Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-26650# Mississippi Univ., University. Dept. of Mechanical Engineering.
AN INVESTIGATION OF TURBULENT MIXING IN THE CHEMICAL LASER USING HOLOGRAPHIC IMAGERY Final Report, 1 Dec. 1975 - 30 Nov. 1979
C. R. Wimberly 31 Dec. 1979 92 p refs
(Grant DAAG29-76-G-0044; DA Proj. 1T1-61102-BH-57)
(AD-A083047; ARO-13224.1-E) Avail: NTIS HC A05/MF A01 CSCL 20/5

An investigation was conducted to determine the mixing characteristics in chemical laser systems using a holographic flow field diagnostic network. Cold flow simulation was done using a variety of nozzles in an effort to uncover the effects of geometry, flow conditions and gas mixture combinations on the mixing of high speed parallel jets. GRA

N80-26651# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
RESEARCH IN LASER PROCESSES Semiannual Report, 1 Feb. - 31 Jul. 1979
A. V. Phelps and A. C. Gallagher 15 Apr. 1980 50 p refs
(Contract N00014-76-C-0123; ARPA Order 2683)
(AD-A083427) Avail: NTIS HC A03/MF A01 CSCL 20/5

A model has been completed of the NaXe discharges examined experimentally under this contract. This model includes the effects of electron excitation, deexcitation and ionization of excited Na atoms, as well as electron loss processes such as dissociative recombination with Na2(-). By adopting apparently reasonable rate coefficients and reaction end products we are able to satisfactorily reproduce the measured steady-state densities of excited Na atoms. However, a serious and unexplained discrepancy is found in the energy balance for these discharges. By extrapolating these results to high Na densities we find what appears to be a region of sufficient optical gain at 700 nm for laser oscillation. Such a laser would require a short excitation pulse (approx. 100 ns) and would have a low discharge impedance. A new technique has been developed for the measurement of electron excitation rate coefficients for the metastable states of the rare gases. A multipass absorption cell and a single mode dye laser allow measurement of metastable densities as low as 1,000,000 atom/cc. GRA

N80-26652# Lockheed Missiles and Space Co., Huntsville, Ala. Huntsville Research and Engineering Center.
PLASMA CHEMISTRY PROCESSES IN THE CLOSED CYCLE EDL Final Report, 5 Jul. 1978 - 5 Jul. 1979
Juergen Thoenes and Shelby C. Kurzius Jul. 1979 161 p refs 2 Vol.
(Contract DAAH40-78-C-0196)
(AD-A083222; LMSC-HREC-TR-D568999; DRCPM-HEL-CR-79-11-Vol-1) Avail: NTIS HC A01/MF A01 CSCL 20/5

Theoretical modeling of plasma chemistry effects on the performance of closed cycle, pulsed, electron beam sustained electric discharge lasers is described. The one dimensional model considers the mutual interaction of the electron beam, the discharge, the plasma and laser radiation. The most important processes are modeled in terms of experimentally controllable parameters which include the post-foil electron beam current density, primary electron energy, applied electric potential, electrode spacing, initial gas composition, temperature and pressure, electron beam and discharge pulse width, and laser cavity characteristics. Results obtained for several laser gas mixtures are described and compared with experimental data. A detailed analysis has been made of test cases for closed cycle devices under development, including the effect on performance of variations in the electric field, the electron beam current, and the gas mixture composition. Electrophilic plasma by-products have been identified, and recommendations have been developed for experimental efforts to verify the predictions. GRA

N80-26653# Lockheed Missiles and Space Co., Huntsville, Ala. Huntsville Research and Engineering Center.
EDLAMP USERS MANUAL
Juergen Thoenes Jul. 1979 37 p refs Supersedes DRDMI-H-CR-77-VOL-2
(Contract DAAK40-75-C-0196)
(AD-A083223; LMSC-HREC-TR-D697555; DRCPM-HEL-CR-79-11-Vol-2; DRDMI-H-CR-77-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 20/5

A computer program is described which can be used to analyze plasma chemistry effects on the performance of pulsed, electron-beam sustained, electric discharge lasers operating either in the open cycle or closed cycle mode. GRA

N80-26654# United Technologies Corp., East Hartford, Conn.
NOVEL RESONATORS FOR HIGH POWER CHEMICAL LASERS Final Report
H. R. Garcia, G. E. Palma, A. W. Angelbeck, R. D. Quinnell, and J. B. Urquhart (Pratt and Whitney Government Products Div.) 1979 66 p
(Contract N00173-79-C-0410)
(AD-A083230) Avail: NTIS HC A04/MF A01 CSCL 20/5

For the equivalent compacted ring resonator, beam injection can help maintain bare resonator power coupling at the unperturbed value. For small misalignments, injection improves bare beam quality, but it does not improve quality degradation due to astigmatism. For the annular ring resonator, beam injection maintains both bare resonator power coupling and beam quality at the unperturbed values for very small misalignments. And, as expected, this resonator is much more sensitive to misalignment than its equivalent compacted resonator. Additionally, the reverse wave analysis has shown the unstable ring/linear stable MO injection configuration to offer satisfactory reverse wave suppression. Based on bare resonator analyses, injection locking shows promise. To determine its potential, loaded resonator analyses for high-power devices must be performed. Mode discrimination, possible parasitics, sensitivity to misalignment, and scale-ability to high power are potential problems that need in-depth investigation. Additionally, the technical issues associated with cavity length equalization to less than lambda; matching of the MO and HEL spectra; and the stability, mode matching and power requirements for the MO need to be addressed experimentally so the real hardware requirements can be established. GRA

N80-26655# Systems Science and Software, Hayward, Calif.
DEVELOPMENT OF SPARK CATHODE ELECTRON GUNS FOR THE CO2 LASER FUSION PROGRAM Final Report, Jul. 1978 - Dec. 1979
G. K. Loda and R. A. Lindstrand Jan. 1980 55 p
(Contract DE-AC08-78DP-40064)
(DOE/DP-40064/1) Avail: NTIS HC A04/MF A01

Spark cathodes are designed and constructed to replace the bladed cold cathode structure in the electron guns of the Los Alamos Scientific Laboratory, Antares, prototype power amplifier and driver amplifier. Design work is described and data from cathode testing is reported. The spark cathode offers precise control of emission site location, design flexibility, and high reliability. DOE

N80-26656# Sandia Labs., Albuquerque, N. Mex.
SIMULATIONS OF THE EFFECT OF APPLIED MAGNETIC FIELDS ON REB DIODES FOR LASER EXCITATION
J. P. Quintenz and M. T. Buttram Jan. 1980 25 p refs
(Contract EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-2138) Avail: NTIS HC A02/MF A01

A computer code is described which simulates the performance of diodes with sidewalls or applied magnetic fields. The effects of applying an external magnetic field on the electron flow pattern in the diodes are detailed. Implications for the design of such diodes to meet applications where the survival of the anode foil is critical are discussed. DOE

N80-26657# Royal Aircraft Establishment, Farnborough (England).
THE PROPAGATION OF FOCUSED TRUNCATED LASER

BEAMS IN THE ATMOSPHERE
A. G. Purcell London HMSO Jun. 1979 31 p refs
(RAE-TM-Math-Comp-7903; BR70928) Avail: NTIS HC A03/MF A01

A formula for the mean intensity distribution resulting from a focused laser beam in the presence of turbulence is confirmed and extended to include annular apertures. Segmented apertures are considered and some indication presented of the likely improvement in focal intensity when the segments are optimally adjusted to counteract turbulence. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-26658* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPOSITE SEAL FOR TURBOMACHINERY Patent
Robert C. Bill and Lawrence P. Ludwig, inventors (to NASA) Issued 10 Jun. 1980 4 p Filed 4 Aug. 1978 Supersedes N78-31103 (16 - 22, p 2897) Division of US Patent Appl. SN-801290, filed 27 May 1977; US Patent-4,135,851 (NASA-CASE-LEW-12131-2; US-Patent-4,207,024; US-Patent-Appl-SN-931090; US-Patent-Class-415-174; US-Patent-Class-415-196; US-Patent-Appl-SN-801290; US-Patent-4,135,851) Avail: US Patent and Trademark Office CSCL 11A

A gas path seal suitable for use with a turbine engine or compressor is provided. A shroud wearable or abradable by the abrasion of the rotor blades of the turbine or compressor shrouds the rotor blades. A compliant backing surrounds the shroud. The backing is a compliant material covered with a thin ductile layer. A mounting fixture surrounds the backing.
Official Gazette of the U.S. Patent and Trademark Office

N80-26659*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIESEL ENGINE CATALYTIC COMBUSTOR SYSTEM Patent Application
Lloyd W. Ream, inventor (to NASA) Filed 6 Jun. 1980 10 p
(NASA-Case-Lew-12995-1; US-Patent-Appl-SN-157150) Avail: NTIS HC A02/MF A01 CSCL 21A

A low compression turbocharged diesel engine is described in which the turbocharger can be operated independently of the engine to power auxiliary equipment. Fuel and air are burned in a catalytic combustor to drive the turbine wheel of the turbine section which is initially caused to rotate by the starter motor. By opening a flapper valve, compressed air from the blower section is directed to the catalytic combustor when it is heated and expanded, serving to drive the turbine wheel and also to heat the catalytic element. To start the engine, one valve is closed, combustion is terminated in the catalytic combustor, and another valve is then opened to utilize air from the blower for the air driven motor. When the engine starts, the constituents in its exhaust gas react in the catalytic element and the heat generated provides additional energy for the turbine section.
NASA

N80-26660*# National Aeronautics and Space Administration. Pasadena Office, Calif.
IMPROVED METHOD FOR DRIVING TWO-PHASE TURBINES WITH ENHANCED EFFICIENCY Patent Application
David G. Elliott, inventor (to NASA) (JPL) Filed 20 Jun. 1980 11 p
(Contract NAS7-100)
(NASA-Case-NPO-15037-1; US-Patent-Appl-SN-161257) Avail: NTIS HC A02/MF A01 CSCL 21A

A method is disclosed for driving a two-phase turbine characterized by an output shaft having at least one stage including a bladed rotor connected in driving relation with the shaft. A two-phase fluid is introduced into the stage at a known flow velocity and caused to pass through the rotor in order to impart angular velocity. The speed of the rotor is controlled so that the angular velocity of the blade tips is equal to at least 50% of the velocity of the flow of the two-phase fluid. NASA

N80-26661*# National Aeronautics and Space Administration. Pasadena Office, Calif.
AN IMPROVED HEAD FOR HIGH SPEED SPINNER HAVING A VACUUM CHUCK Patent Application
Frank Lombardi, inventor (to NASA) (JPL) Filed 27 Jun. 1980 12 p
(Contract NAS7-100)
(NASA-Case-NPO-15227-1; US-Patent-Appl-SN-163840) Avail: NTIS HC A02/MF A01 CSCL 13I

A head for a high-speed spinner is characterized by a cylindrical body adapted to be mounted at the distal end of a vertically oriented drive shaft. A vacuum chuck having an upwardly facing chamber is circumscribed by an annular surface for receiving a silicon chip. An ordered array of low-pressure cavities is defined about the periphery of the body and is connected with the chamber via radially extended bores for translating low pressures to the chamber as the head is angularly displaced. A pressure differential is thus established across the chip for securing it to the head.
NASA

N80-26662*# Rocketdyne, Canoga Park, Calif.
SMALL, HIGH PRESSURE LIQUID HYDROGEN TURBOPUMP Final Report, 7 Jun. 1977 - 26 Oct. 1979
A. Csomor and D. J. Warren 23 May 1980 234 p refs
(Contract NAS3-21008)
(NASA-CR-159821; RI/RD79-322) Avail: NTIS HC A11/MF A01 CSCL 13K

A high pressure, low capacity, liquid hydrogen turbopump was designed, fabricated, and tested. The design configuration of the turbopump is summarized and the results of the analytical and test efforts are presented. Approaches used to pin point the cause of poor suction performance with the original design are described and performance data are included with an axial inlet design which results in excellent suction capability. E.D.K.

N80-26663*# National Aeronautics and Space Administration, Washington, D. C.
STUDIES ON QUESTIONS OF DESIGN AND CONSTRUCTION OF CHAIN SCRAPER CONVEYORS
Hubert Guder Mar. 1980 35 p refs Transl. into ENGLISH of Glueckauf-Forschungshefte, (West Germany) v. 30, no. 3, Jun. 1969 p 103-116 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75810) Avail: NTIS HC A03/MF A01 CSCL 13I

The basic behavior of mining crushed goods in chain scraper conveyors was examined using a special test stand. The characteristics resistance lines of the upper end-piece were determined for conveyor idle as a function of the determinative crushed good characteristics (granular structure, moisture content, type of goods) on the size of the conveyor load, on the conveyor construction and on the stopped time of the conveyor. Crushed goods with a narrow granular profile and sphere-like grains caused about 35% greater resistance than fine coal and raw coal with broad granular profile. For goods containing water more than 10% by weight, the solids friction retreated in favor of flow friction. The coefficient of resistance decreased considerably in the range of lower speeds and then increased with increasing conveyor speed. The conveyance of sandstone ore required about 280% greater specific drive than the conveyance of raw coal. Resistance coefficients for coal and raw coal showed no dependence on the design of the conveyor. Start-up of loaded conveyors after longer stop times was simulated and the specific break-loose force was determined. A.R.H.

N80-26664*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
INVESTIGATIONS INTO THE MECHANICAL BEHAVIOR OF COMPOSITE BOLTED JOINTS
J. C. Perry (Old Dominion Univ. Research Foundation) and M. W. Hyer Jun. 1979 63 p refs
(Grant NsG-1167)
(NASA-CR-163295; VPI-E-79-22) Avail: NTIS HC A04/MF A01 CSCL 13I

Testing procedures and data reduction and interpretation techniques were established for a program to study the mechanical behavior of bolted joints at room temperature, -157 C (-250 F), and 315 C (600 F). The load transfer characteristics, from one

bolt to another, in double-bolt joints were investigated by examining data generated in previous investigations. From the results, it appears the increase in load-carrying capacity by adding a second bolt in tandem can be predicted. A.R.H.

N80-26665*# Connecticut Univ., Storrs. Dept. of Mechanical Engineering.
TURBINE ENDWALL TWO-CYLINDER PROGRAM Semiannual Report, 1 Jan. - 1 Jul. 1980
Lee S. Langston 1 Jul. 1980 49 p ref
(Grant NsG-3238)
(NASA-CR-163026; SASR-3) Avail: NTIS HC A03/MF A01 CSCL 21A

Progress is reported in an effort to study the three dimensional separation of fluid flow around two isolated cylinders mounted on an endwall. The design and performance of a hydrogen bubble generator for water tunnel tests to determine bulk flow properties and to measure main stream velocity and boundary layer thickness are described. Although the water tunnel tests are behind schedule because of inlet distortion problems, tests are far enough along to indicate cylinder spacing, wall effects and low Reynolds number behavior, all of which impacted wind tunnel model design. The construction, assembly, and operation of the wind tunnel and the check out of its characteristics are described. An off-body potential flow program was adapted to calculate normal streams streamwise pressure gradients at the saddle point locations. A.R.H.

N80-26666# Orshansky Transmission Corp., San Diego, Calif.
DESIGN AND DEVELOPMENT OF A CONTINUOUSLY VARIABLE RATIO TRANSMISSION FOR AN AUTOMOTIVE VEHICLE, PHASE 4 Quarterly Progress Report
31 May 1978 87 p
(Contract EY-76-C-03-1165)
(SAN-1165-T2) Avail: NTIS HC A05/MF A01

Progress in the design and development of a continuously variable ratio transmission for an automotive vehicle is reported. The major automotive hydromechanical transmission development problem continues to be the reduction of hydrostatic noise and the project plan, therefore, concentrated on the new hydrostatic module. The potential for achieving acceptably low noise levels in the second generation hydromechanical transmission was assessed by comparing the noise levels of the hydrostatic modules for the first and second generation transmissions. A set of twelve test points was selected, comprising of road load, steady state, and wide-open-throttle acceleration at 10, 20, 30, 40, 50, and 60 mph. The module operating conditions for the two transmissions at each of these twelve points were calculated. Baseline noise data was measured on the first generation module. The results are given; testing of co-axial hydrostatic module for second generation hydromechanical transmission will be emphasized. DOE

N80-26667# Babcock and Wilcox Co., Alliance, Ohio. Research and Development Div.
DEVELOPMENT OF AUTOMATED WELDING PROCESSES FOR FIELD FABRICATION OF THICKWALLED PRESSURE VESSELS: ELECTRON BEAM METHOD Quarterly Report, 1 Jul. - 30 Sep. 1979
Charles M. Weber 1979 29 p
(Contract EF-77-C-01-2606)
(FE-2606-8; QR-8) Avail: NTIS HC A03/MF A01

An electron beam welding procedure for welding 8 inch thick SA 387 Grade 22 Class (2-1/4 Cr-1 Mo) steel is described. A total of 469 experimental welds were made to date. Efforts to develop welding procedures which produce defect-free welds were successfully completed. Techniques for acceptably starting and stopping electron beam welds were developed. Work on developing an EB repair technique is in progress. It was learned that re-welding of holes, without metal additions, is unacceptable. Work to define the joint fit-up requirements is nearly complete. A considerable amount of joint mismatch can be readily welded and a joint gap opening in excess of 0.100 inch can be welded without alteration of the welding procedure. Another large test plate was welded using equipment with a modified drive. The weld was unacceptable due to porosity. It appears that poor base metal quality is adversely affecting weld quality. Specimens for testing the as-welded mechanical properties have been machined and are being tested. DOE

N80-26668# Klöeckner-Humboldt-Deutz A.G., Cologne (West Germany).
LOW EMISSION VEHICLE ENGINE BASED ON THE AD PROCESS Final Report
H. Kuepper Jun. 1979 141 p refs
(DOE-TR-212) Avail: NTIS HC A07/MF A01

An existing multifuel system, derived from a diesel engine (AD system KHD) was designed for running on gasoline only. The advantages of the diesel engine (low specific fuel consumption and low gaseous emissions) are combined with those of the Otto engine (high specific power, no soot). The system selected for the transfer to the multicylinder engine is characterized by late mixing of fuel and air near the wall of the piston bowl. It is suitable for supercharging and its fuel consumption is typical for diesel engines. Moreover, the system has low black smoke levels and is largely insensitive to the octane and cetane numbers of the fuel. The relatively high HC and CO emissions of the system were reduced by the installation of a precious metal catalyst. The multicylinder engine BF 6 L 510 adapted with the Deutz-stratified charge system was installed in a Magirus-Deutz R 81 bus with which test bed and roller dynamometer trials were carried out. DOE

N80-26669# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
HIGH-TEMPERATURE TURBINE TECHNOLOGY PROGRAM LOW-Btu GAS, LOW-TEMPERATURE CHEMICAL CLEANUP PILOT PLANT: DESIGN, CONSTRUCTION, STARTUP, AND OPERATION
M. W. Horner, A. Caruvana, G. A. Cincotta, J. C. Corman, K. L. House, S. G. Kimura, R. G. Lavigne, C. C. Lawson, C. K. Neulander, H. K. Ruhl et al Feb. 1980 89 p refs
(Contract EX-76-C-01-1806)
(FE-1806-78) Avail: NTIS HC A05/MF A01

The completion of the low Btu gas, low temperature cleanup system pilot plant represents a major step toward a complete integrated coal gasification pilot plant which simulates the full-scale commercial Coal Gasification Combined Cycle Plant. Several important programmatic and technical milestones in the program were attained during the design, construction, and startup of the pilot scale chemical cleanup system. The ability to operate the system in a 30 hr fired test after only three short attempts at fired operation, attests to the excellence of the plant design, preparation, and operation personnel. The performance of the Benfield system met or exceeded expectations based on sulfur and carbon dioxide removal. The reheat and saturation equipment performed well and controllably. No evidence of foaming or mist carry over to the process gas stream was observed, and the particulate and alkali loading of the clean process gas was well within design limitations. DOE

N80-26670# Argonne National Lab., Ill.
CLASSIFICATION AND EVALUATION OF ELECTRIC MOTORS AND PUMPS
Feb. 1980 251 p refs
(Contract W-31-109-eng-38)
(DOE/CS-0147) Avail: NTIS HC A12/MF A01

Classification and evaluation of electric motors and pumps are discussed. The industrial, transportation, commercial, agricultural, and municipal sectors of the US economy are studied. The range of electric motors included all ac and dc integral and fractional hp units equalling or exceeding 1/6 hp. However, units of less than 1/6 hp and those in use in other than the previously defined sectors were treated to ensure completeness. Pump equipment covered included the wide range of fluid handling equipment powered by all energy forms. The range of sizes analyzed correlated with those for motors, roughly 1/6 to 20,000 shaft hp. An analysis task called for developing scenarios for the policy options based on labeling and standards, evaluating barriers to their implementation, and then evaluating probable results. DOE

N80-26671# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
DEVELOPMENT OF HIGH-TEMPERATURE TURBINE

SYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS PHASE 2 Quarterly Report, Oct. - Dec. 1979
1979 129 p ref
(Contract EX-76-C-01-1806)
(FE-1806-76) Avail: NTIS HC A07/MF A01

The development of a high temperature gas turbine for use in a combined cycle power plant, with coal-derived fuel, at a firing temperature of 2600 F and with growth capability to 3000 F is discussed. Component design and technology testing and system design and trade-off analyses are described including hot gas path development tests, turbine simulator tests, low temperature-low Btu gas cleanup system, and aerodynamic evaluations. DOE

N80-26672# General Atomic Co., San Diego, Calif. HTGR Systems Dynamics Branch.
DYNAMICS AND CONTROL MODELING OF THE CLOSED-CYCLE GAS TURBINE (GT-HTGR) POWER PLANT
Alexander Bardia Feb. 1980 30 p refs Presented at 4th Power Plant Dyn., Control and Testing Symp., Gatlinburg, Tenn., 17-19 Mar. 1980 Submitted for publication
(Contract DE-AT03-76SF-70046)
(GA-A-15677; CONF-800332-1) Avail: NTIS HC A03/MF A01

A 800 MW(e) two-loop gas turbine high temperature gas cooled reactor (GT-HTGR) plant design is simulated with a transient analysis computer code, and the modeling of control strategies called for by the inherently unique operational requirements of a multiple loop GT-HTGR is described. Plant control of the GT-HTGR is constrained by the nature of its power conversion loops in which the core cooling flow and the turbine flow are directly related and thus changes in flow affect core cooling as well as turbine power. Additionally, the high thermal inertia of the reactor core precludes rapid changes in the temperature of the turbine inlet flow. DOE

N80-26673# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
EFFECT OF THE WATER CONTENT OF OIL IN GEAR BOXES ON THEIR LIFETIMES [INFLUENCE DE LA TENEUR EN EAU DE L'HUILE DE BOITES D'ENGRENAGES SUR LEUR DUREE DE VIE]
Jacques Odorico and Jean Philippe 7 Aug. 1979 10 p In FRENCH Presented at Groupement pour l'Avan. de la Mecan. Ind. Conf. (Journees d'Etudes sur la Fatigue-Corrosion)
(SNIAS-792-551-105) Avail: NTIS HC A02/MF A01

Fatigue tests were carried out on gears cut out of 16NCD 13 and subject to the following treatment: machining, cementing, quenching and tempering, and rectification. Behavior with ordinary oil and oil with additional water (0.15 to 0.20%) was investigated. The apparatus simulating real conditions is described and the results obtained are given. Two types of control appear to be necessary: determination of the water content of fresh oil after storage, monitoring the magnesium content of oil sampled from operational gear boxes (the excess acidity caused by the water attacks the casing) using spectroscopic methods or simple visual inspection (blackening of the oil). Author (ESA)

N80-26674# General Electric Co., Whetstone (England). Reactor Equipment Ltd.
ROTOR: A FORTRAN PROGRAM TO CALCULATE THE CRITICAL SPEEDS OF ROTATING SHAFTS
P. Brooks and D. L. Duffett Jan. 1979 41 p refs Supersedes REL/TM(78)23
(REL/R(79)2; REL/TM(78)23) Avail: NTIS HC A03/MF A01

A computer program is described written in FORTRAN for the PDP 11-70 which can be used to calculate any number of critical speeds of transverse vibration of a rotating shaft supported in two bearings. It can deal with a shaft of variable cross section, with hollow or solid sections, and carrying additional discs. In the calculations the resistance of the bearings and the gyroscopic effects are taken into account. Operating instructions, method of calculation, comparisons made with other methods of calculation, and test problems are given. Author (ESA)

N80-26675# National Centre of Tribology, Risley (England). European Space Tribology Lab.
[SPACE TRIBOLOGY TESTS AND EXPERIMENTS] Progress Report, 1978
E. J. Robbins Sep. 1979 14 p refs
(Contract ESA-2584/75-MD)
(ESA-ESTL-43; ESA-CR(P)-1310) Avail: NTIS HC A02/MF A01

Mechanism tests and experiments in support of tribological research are described. Thermal vacuum tests of various solar array drive mechanisms to be used on satellites are reported on. In addition, results from slip ring tests, sleeve bearing tests, and boom hinge bearing tests are given. The torque of ball bearings using dry lubricants, the relative lubricity of oils, and cage effects in oil lubricated bearings are considered. Ball bearings with titanium carbide coated balls are also investigated. Author (ESA)

N80-26676# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Betriebsbereich Ottobrunn.
DEVELOPMENT OF AN EXHAUST NOISE SUPPRESSOR WITH NEGLIGIBLE BACK PRESSURE Final Report
Paul J. VandenBrulle Bonn Bundesmin. fuer Forsch. u. Technol. May 1979 33 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-HA-79-02) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 6,50

Methods of exhaust noise reduction were studied using mufflers of small sizes and negligible back pressures. One muffler was designed to permit the adding in series of an ejector with ejector chamber and achieved a noise reduction of 28 dB with negligible pressure loss. Another muffler was developed using a combination of ejector effect, partitioning of the jet stream, and acoustic absorption. This muffler achieved a noise reduction of 22 dB with no pressure loss. Author (ESA)

N80-26677# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Betriesbereich.
VIBRATION ABSORBERS FOR DAMPING OF SOLID STATE NOISE Final Report
Helmut Albrecht Bonn Bundesmin. fuer Forsch. u. Technol. May 1979 45 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-HA-79-03) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9,05

Methods were studied to damp mechanical vibrations of machines in industrial plants and thus achieve noise reductions. It is shown that metal bar absorbers of various shapes are more efficient than antidrumming compounds and sand of the same mass. Tests on industrial machines showed that noise reductions of up to 7 dB could be achieved. Author (ESA)

N80-26678# Southampton Univ. (England). Inst. of Sound and Vibration Research.
DIAGNOSTICS OF GEAR ASSEMBLY: A NEW APPROACH USING IMPACT ANALYSIS
M. F. Ranky (Acad. of Sci., Budapest) Aug. 1978 29 p refs
(ISVR-TR-100) Avail: NTIS HC A03/MF A01

A technique which employs torsional excitation and an accelerometer fitted to the structure is used to estimate the backlash distribution of gears in mesh. Imperfections in circularity are computed from measured data in terms of absolute phase lags and normalized magnitudes. The theoretical concepts are outlined and results of experiments are presented. Author (ESA)

N80-26679# AiResearch Mfg. Co., Torrance, Calif.
EFFECT OF MACHINE LENGTH ON THE PERFORMANCE OF LINEAR INDUCTION MOTORS: AN EXPERIMENTAL INVESTIGATION Final Report, Jun. 1976 - Aug. 1977
R. J. A. Bevan Jan. 1979 252 p refs
(PB80-156243; FRA/ORD-79/07) Avail: NTIS HC A12/MF A01 CSCL 13F

The full-scale testing of a 10 pole, double-sided linear induction motor, for a research vehicle modified to permit excitation of 9, 5, 4, or 2 poles in addition to full to-pole excitation is described. Testing in reduced-pole configurations enabled the effect of a discontinuous excitation at the front and rear of the motor to be investigated, as well as the validity of certain mathematical models that assume infinite primary iron extending in the forward and reverse directions. A mathematical model of the motor is also presented that shows good correlation with

test results. The motor had a peak thrust capability of 15.3kN at 60 m/s at an excitation current of 2000 A. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-26680# Lockheed-California Co., Burbank.
SUMMARY OF 1979 INDEPENDENT RESEARCH ON RISK ANALYSIS METHODS
L. Bekow and J. C. Ekvall 22 Dec. 1977 43 p refs
(LR-28390) Avail: NTIS HC A03/MF A01

A statistical analysis was conducted on aluminum superconducting-nonconducting (S-N) fatigue test data. The scatter (log normal standard deviation) for S-N data is comparable to the scatter for spectrum fatigue test data. However, the log normal standard deviation of the S-N data was larger than spectrum fatigue data for higher levels of confidence. Scatter factors to be applied to fatigue test results were worked out for various levels of probability and confidence. The scatter characteristics of the K sub Ic aluminum fracture toughness data was also evaluated. A statistical procedure was developed to determine A-basis and B-basis fracture toughness values. B.D.

N80-26681*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
RAPID DATA COMPARISON TECHNIQUE DEVELOPMENT FOR N-RAY/X-RAY ANALYSIS Final Report
Robert L. Butterfield Oct. 1979 9 p
(NASA-TM-81089; KSC-TR-60-1) Avail: NTIS HC A02/MF A01 CSCL 14D

An operational N-ray/X-ray computer analysis system for nondestructive testing problems was realized by developing: (1) more efficient data transfer routines for use in existing image processing systems; (2) the capability to store and analyze multiple N-ray/X-ray images; (3) an efficient 2-D Fast Fourier Transform; and (4) transfer functions compensation capability to correct for distortions and nonlinearities of N-rays/X-rays. Applications of the technique are summarized for the following: thermal protection system tile with hydraulic fluid; thermal protection system tile with corrosion; thermal protection system tile debonding; stainless steel tubing corrosion; defective electrical devices; fast film restoration and deblur; corrosion tracking over time; reduction of source vignetting, and identification of materials (O rings, Teflon parts, soft goods) via table look up. A.R.H.

N80-26682*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUANTITATIVE ULTRASONIC EVALUATION OF ENGINEERING PROPERTIES IN METALS, COMPOSITES AND CERAMICS
Alex Vary 1980 18 p refs Presented at First Seminar on Advanced Ultrasonic Tech., Longueuil, Quebec, 9-10 Jun. 1980; sponsored by National Research Council of Canada
(NASA-TM-81530; E-482) Avail: NTIS HC A02/MF A01 CSCL 14D

Ultrasonic technology from the perspective of nondestructive evaluation approaches to material strength prediction and property verification is reviewed. Emergent advanced technology involving quantitative ultrasonic techniques for materials characterization is described. Ultrasonic methods are particularly useful in this area because they involve mechanical elastic waves that are strongly modulated by the same morphological factors that govern mechanical strength and dynamic failure processes. It is emphasized that the technology is in its infancy and that much effort is still required before all the available techniques can be transferred from laboratory to industrial environments. E.D.K.

N80-26683# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
ESTIMATORS FOR THE BINOMIAL FAILURE RATE COMMON CAUSE MODEL Interim Report
Corwin L. Atwood Mar. 1980 83 p refs Prepared for Nuclear Regulatory Comm., Washington, D.C.
(Contracts EY-76-C-07-1570; DE-AC07-76ID-01570)
(EGG-EA-5112; NRC-FIN-A6292) Avail: NTIS HC A05/MF A01

A binomial failure rate model wherein a system of m components is hit by random shocks which may cause components simultaneously to fail, each component with equal probability is examined. Individual components may also fail when no shock has occurred. The data possibilities considered are that causes of single failures are identifiable (as shock or not) or not identifiable. Given data from such a system, non-Bayesian and Bayesian point and interval estimators are found for the various quantities of interest. Residual analyses and hypothesis tests are presented for checking the model assumptions. An example is worked out. DOE

N80-26684# Societe Nationale Industrielle Aerospatiale, Paris (France). Lab. Centrale.
ACCELERATED AND NATURAL AGING OF GLUED ASSEMBLIES USED IN AERONAUTICS [VIEILLISSEMENT ACCELERE ET VIEILLISSEMENT NATUREL D'ENSEMBLES COLLES UTILISES DANS L'AERONAUTIQUE]
G. Briens 22 Aug. 1979 27 p In FRENCH Presented at Forum Intern. Mater. Composites, Collage et Adhesion, Lyon, 11-14 Sep. 1979
(SNIAS-792-551-107) Avail: NTIS HC A03/MF A01

Conditions prevalent in tropical, equatorial, polar, and marine environments were simulated in order to determine the behavior and performance of thin film adhesives used to bond aluminum alloys in aircraft structures. The effects of humidity, surface treatment, and the nature of the adhesive were determined. Various types of shear stress tests were used. Variables included conditions of exposure (without loads, static loads, dynamic loads) and the ambient temperature of the humidity (50 C, 60 C, and 70 C.) Accelerated life tests conducted at 70 C with 100% humidity for 750 h, at 35 C with 5% NaCl for 750 h, and at 100 h in dry heat permitted the rapid elimination of adhesives with unsatisfactory performance. Transl. by A.R.H.

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-26685 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 12, NO. 1
Judith Nagle-Eshleman, ed. Jan. 1980 104 p refs
(AD-A081171) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375: $15.00 set, annual rate $100.00 CSCL 20/11

Transient problems of submerged elastoplastic structures and advances in helicopter vibration control are addressed. A bibliography dealing with shock and vibration technology is included. For individual titles, see N80-26686 through N80-26687.

N80-26686 Illinois Univ. at Chicago Circle, Chicago. Dept. of Materials Engineering.
SOME TRANSIENT PROBLEMS OF SUBMERGED ELASTO-PLASTIC STRUCTURES
D. Krajcinovic *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., V. 12, No. 1 Jan. 1980 p 15-19 refs (For primary document see N80-26685 17-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375: $15.00/set, annual rate $100.00

The elasto-plastic response of dynamically loaded cylindrical shells submerged in acoustic medium is addressed. The time dependent load, inertia forces, and fluid resistance (radiated pressure) cause the regions of plastic stresses in the shell to appear, grow, move, shrink, and disappear only to appear again. Mathematically, the problem is governed by two systems of partial

differential equations in the shell; one is for the elastic and the other for plastic regions. The wave equation represents the fluid (external domain). The systems of equations are coupled by matching conditions on moving boundaries; this matching process further complicates the problem. The complexity of the numerical solution to the problem is emphasized and possibilities of solution discussed. J.M.S.

N80-26687 City Univ., London (England). Dept. of Mechanical Engineering.
RECENT ADVANCES IN HELICOPTER VIBRATION CONTROL
G. T. S. Done *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., V. 12, No. 1 Jan. 1980 p 21-25 refs (For primary document see N80-26685 17-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

The control of forced vibration excitation and response of helicopter airframes is addressed. Methods and hardware for vibration control, including isolators, absorbers, direct rotor control, and structural modification are considered. J.M.S.

N80-26688 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 12, NO. 3
Judith Nagle-Eshleman, ed. Mar. 1980 102 p refs
(AD-A082399) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

The ability of shock and vibration tests to predict the response structures to shock loads is addressed. Dynamic tests techniques, the shock response spectrum approach, and applications of the periodic structures theory to vibration testing are covered. For individual titles, see N80-26689 through N80-26691.

N80-26689 Hughes Aircraft Co., Culver City, Calif.
DYNAMIC TESTING: HOW FAR WE'VE COME, HOW MUCH FURTHER TO GO
A. J. Curtis *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., V. 12, No. 3 Mar. 1980 p 3-8 Presented at the 50th Shock and Vibration Symp., Colorado Springs, Colo., Oct. 1979 (For primary document see N80-26688 17-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

An overview of dynamic test techniques is given and the route of past technical developments is extrapolated to predict likely future capabilities. In parallel, shortcomings of these techniques vis-a-vis desired capabilities are examined to detect where improvements are most needed and/or can most readily be achieved. Particular attention is devoted, on the one hand, to the future of the most sophisticated techniques of digital control, and on the other hand, to the simplicity desired for screening tests. J.M.S.

N80-26690 National Aerospace Lab., Tokyo (Japan).
SHOCK RESPONSE SPECTRUM AND MAXIMAX RESPONSE
Y. Matsuzaki *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., V. 12, No. 3 Mar. 1980 p 11-15 refs (For primary document see N80-26688 17-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

A literature survey on the shock response spectrum and the greatest maximum, or maximax, response of structures subjected to shock loads is given. The shock response spectrum (SRS) approach is simple, well established, and easy to apply, particularly to single degree of freedom systems. It is shown that the SRS approach has been applied to large structures with many degrees of freedom and the maximax response of a linear structure has been predicted from the information of the upper limit of the load energy or the response of energy transmitted by the load. The loading condition for the maximax response is specified more grossly than for the SRS. The maximax response is considered a useful alternative for design and analysis. J.M.S.

N80-26691 Boeing Commercial Airplane Co., Seattle, Wash.
VIBRATION OF PERIODIC STRUCTURES
G. SenGupta *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., V. 12, No. 3 Mar. 1980 p 17-31 refs (For primary document see N80-26688 17-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

Many practical engineering structures consist of many basic periodic units. Aircraft fuselages, ship hulls, tall multi-storied buildings, periodically supported pipes, composite materials, and heat exchanger tube banks in a nuclear reactor are examples. Application of periodic structure theory to the analysis of dynamic responses of such structures is reviewed. J.M.S.

N80-26692 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 12, NO. 4
Judith Nagle-Eshleman, ed. Apr. 1980 101 p refs
(AD-A084108) Avail: SVIC, Code 5804 Naval Research Lab., Washington, D.C. 20375; $15.00/ set, annual rate $100.00 CSCL 20/11

A review of dynamic analysis and design is given with emphasis on space craft design. A bibliography of shock and vibration technology is included. For individual title, see N80-26693.

N80-26693 Boeing Aerospace Co., Seattle, Wash.
DYNAMIC ANALYSIS AND DESIGN: CHALLENGE FOR THE FUTURE
R. W. Hager *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., V. 12, No. 4 Apr. 1980 p 3-12 Presented at the 50th Shock and Vibration Symp., Colorado Springs, Colo., Oct. 1979 (For primary document see N80-26692 17-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set, annual rate $100.00

A review of the history of dynamic analysis and design through the past 49 sessions of the Shock and Vibration Symposia is given. The significant progress made, and the problems and shortcomings being encountered today are examined. Concerns and challenges for the future of dynamic analysis and design are discussed. J.M.S.

N80-26694*# National Aeronautics and Space Administration, Washington, D. C.
THE NASTRAN USER'S MANUAL (LEVEL 17.0)
Dec. 1979 867 p
(NASA-SP-222(04)) Avail: NTIS HC A99/MF A01 CSCL 20K

NASTRAN embodies a lumped element approach, wherein the distributed physical properties of a structure are represented by a model consisting of a finite number of idealized substructures or elements that are interconnected at a finite of grid points, to which loads are applied. All input and output data pertain to the idealized structural model. The general procedures for defining structural models are described and instructions are given for each of the bulk data cards and case control cards. Additional information on the case control cards and use of parameters is included for each rigid format. A.R.H.

N80-26695*# Rohr Industries, Inc., Chula Vista, Calif.
DESIGN AND FABRICATION OF TITANIUM MULTI-WALL THERMAL PROTECTION SYSTEM (TPS) TEST PANELS Contractor Report, Jan. - Aug. 1979
Winford Blair, John E. Meaney, Jr., and Herman A. Rosenthal Feb. 1980 66 p
(Contract NAS1-15646)
(NASA-CR-159241; RHR-79-111) Avail: NTIS HC A04/MF A01 CSCL 20K

A titanium multiwall thermal protection system panel was designed. The panel is a nine sheet sandwich structure consisting of an upper and lower face sheet; four dimpled sheets, three septum sheets, and clips for attachment to a vehicle structure. An acceptable fabrication process was developed, and the panel design was verified through mechanical and thermal testing of component specimens. A design was completed which takes into consideration fabrication techniques, thermal properties, mechanical properties, and materials availability. B.D.

N80-26696*# General Electric Co., Philadelphia, Pa.
VIBRATION ANALYSIS OF THE LONG DURATION EXPO-

SURE FACILITY (LDEF) USING SPAR
Harold Edighoffer Jun. 1980 96 p refs
(Contract NAS1-14375)
(NASA-CR-159239) Avail: NTIS HC A05/MF A01 CSCL 20K

The structural modeling of the Long Duration Exposure Facility (LDEF) utilizing the SPAR system of computer programs for vibration analysis is discussed. The technical areas of interest were: (1) development of the LDEF finite element model; (2) derivation of tray effective panel stiffness matrix using finite element tray models; (3) assessment of attachment conditions and end fitting flexibility by comparing SPAR with test static displacements; (4) SPAR grouping; and (5) derivation of the LDEF frequencies and mode shapes and comparing them with tests. Special detailed finite element modeling was required to obtain good agreement between analytical and test vibration modes. An orthotropic panel in the overall model was developed. Orthotropic stiffness for this panel were obtained from finely detailed statically loaded SPAR models which included stiffness and allowed for partial relative sliding of the tray clamping attachments. Sensitivity to LDEF joint boundary conditions was determined, and static test data proved valuable in assessing modeling of local end fittings. B.D.

N80-26697*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
NONLINEAR TRANSIENT ANALYSIS BY ENERGY MINIMIZATION: A THEORETICAL BASIS FOR THE ACTION COMPUTER CODE
Manohar P. Kamat Jul. 1980 109 p refs
(Contract NAS1-15080; Grants NGR-47-004-14; NsG-1546)
(NASA-CR-3287) Avail: NTIS HC A06/MF A01 CSCL 20L

The formulation basis for establishing the static or dynamic equilibrium configurations of finite element models of structures which may behave in the nonlinear range are provided. With both geometric and time independent material nonlinearities included, the development is restricted to simple one and two dimensional finite elements which are regarded as being the basic elements for modeling full aircraft-like structures under crash conditions. Representations of a rigid link and an impenetrable contact plane are added to the deformation model so that any number of nodes of the finite element model may be connected by a rigid link or may contact the plane. Equilibrium configurations are derived as the stationary conditions of a potential function of the generalized nodal variables of the model. Minimization of the nonlinear potential function is achieved by using the best current variable metric update formula for use in unconstrained minimization. Powell's conjugate gradient algorithm, which offers very low storage requirements at some slight increase in the total number of calculations, is the other alternative algorithm to be used for extremely large scale problems. A.R.H.

N80-26698*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
STRAIN MEASUREMENTS IN COMPOSITE BOLTED-JOINT SPECIMENS
Michael W. Hyer, Michael C. Lightfoot (Old Dominion Univ. Research Foundation), and James C. Perry (Old Dominion Univ. Research Foundation) May 1979 87 p refs
(Grant NsG-1167)
(NASA-CR-163296; VPI-E-79-17) Avail: NTIS HC A05/MF A01 CSCL 20K

Strain data from a series of bolted joint tests is presented. Double lap, double hole, double lap, single hole, and open hole tensile specimens were tested and the strain gage locations, load strain responses, and load axial displacement responses are presented. The open hole specimens were gaged to determine strain concentration factors. The double lap, double hole specimens were gaged to determine the uniformity of the strain in the joint and the amount of load transferred past the first bolt. The measurements indicated roughly half the load passed the first bolt to be reacted by the second bolt. Author

N80-26699# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OPTIMIZATION AND STABILITY OF COLUMNS UNDER OPPOSING DISTRIBUTED AND CONCENTRATED LOADS
Sarp Adali Oct. 1979 45 p refs
(CSIR-TWISK-122) Avail: NTIS HC A03/MF A01

A bar subjected to simultaneous compressive and tensile axial loads, which behaves like either a column or tie, depending on the relative magnitudes of these loads is examined along with the resulting stability boundary which separates a conditionally stable region (column action) from an unconditionally stable region (tie action). The optimal design of the structure, when in the conditionally stable region is presented. The stability boundaries of uniform and optimal columns are given for various problem parameters. The columns are elastically clamped at one end and free at the other, and subjected to nonuniformly distributed and concentrated loads which act in opposite directions. The cross sectional area is determined, such as to maximize the load carrying capacity of the column subject to volume and thickness constraints. That variational bounds are given which provide upper and lower estimates on the buckling loads of optimal columns. Stability problems are formulated which arise in connection with columns attached to the rim or hub of a rotating wheel. B.D.

N80-26700*# Lehigh Univ., Bethlehem, Pa.
VISCOELASTIC ANALYSIS OF ADHESIVELY BONDED JOINTS
F. Delale and F. Erdogan Mar. 1980 28 p refs
(Grants NGR-39-007-011; NSF ENG-78-09737)
(NASA-CR-159294) Avail: NTIS HC A03/MF A01 CSCL 20K

An adhesively bonded lap joint is analyzed by assuming that the adherends are elastic and the adhesive is linearly viscoelastic. After formulating the general problem a specific example for two identical adherends bonded through a three parameter viscoelastic solid adhesive is considered. The standard Laplace transform technique is used to solve the problem. The stress distribution in the adhesive layer is calculated for three different external loads, namely, membrane loading, bending, and transverse shear loading. The results indicate that the peak value of the normal stress in the adhesive is not only consistently higher than the corresponding shear stress but also decays slower. Author

N80-26701*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEFLECTIONS OF BEAM COLUMNS ON MULTIPLE SUPPORTS
W. Jefferson Stroud, William H. Greene, and Melvin S. Anderson Jun. 1980 19 p refs
(NASA-TM-81829) Avail: NTIS HC A02/MF A01 CSCL 20K

Lateral deflections of beam columns on multiple equally spaced supports are calculated using the STAGS nonlinear structural analysis computer program. Three lateral loadings are considered, uniform, linear, and uniform over only the center bay. Two types of boundary conditions are considered at the end supports, clamped, and simple support. The effect of an initial sinusoidal imperfection are considered. Deflections in the center and end bays of the beam columns are presented as a function of applied axial compressive load. As the number of bays becomes large, the effect of boundary conditions on the deflections in the center bays diminishes. For cases involving a uniform or linearly varying load, imperfections can have a much larger effect on deflections in the center bays than can lateral pressure. E.D.K.

N80-26702# California Univ., Berkeley. Lawrence Berkeley Lab. Nuclear Theory Group.
ROLE OF FLUCTUATIONS IN THE QUANTAL DESCRIPTION OF DAMPED MOTION
E. S. Hernandez Jan. 1980 30 p refs Sponsored in part by Consejo Nacl. de Invest. Cient. y Tech. of Argentina
(Contract W-7405-eng-48)
(LBL-10321) Avail: NTIS HC A03/MF A01

The construction of a frictional time dependent Schroedinger equation is reviewed for harmonic motion in a restricted framework, i.e., demanding the conservation of the Gaussian shape of wave packets. The evolution of the quanta fluctuations is discussed in a time dependent model, and it is shown that such a situation does not correspond to damped harmonic oscillations. The role of fluctuations in providing dissipative

behavior is discussed and the time evolution of arbitrary wave functions subject to damped motion as described by Schroedinger-Kostin equation is analyzed in detail. DOE

N80-26703# Sandia Labs., Albuquerque, N. Mex.
FLEXURAL RESPONSE ON KEVLAR/EPOXY COMPOSITE BEAMS ADHESIVELY BONDED AT THE MID-PLANE
T. R. Guess and R. E. Allred 1980 54 p refs Presented at 25th Natl. SAMPE Symp., San Diego, Calif, 6 May 1980
(Contract EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1356C; CONF-800518-1) Avail: NTIS HC A04/MF A01

The results of an analytical and experimental study to determine the effect of a thin adhesive interlayer on the flexural stiffness and strength of warp aligned Kelvar 49 style 143 fabric/55208 epoxy composite beams are reported. Layered and solid composite laminate constructions 12.5 mm thick were analyzed by finite element techniques. The layered construction consisted of two 6.25 mm thick laminates bonded together with a 0.076 to 0.229 mm adhesive bond. Bend test runs at 22 C verified that the layered and solid beams have essentially identical stiffness and strength. Changes indicate the temperature depends on the composite. DOE

N80-26704# Societe Nationale Industrielle Aerospatiale, Paris (France).
EXPERIMENTAL METHODOLOGY AND THE APPLICATION OF RUPTURE MECHANICS CONCEPTS TO METALS
J. Odorico 1979 22 p In FRENCH; ENGLISH summary Presented at 14th. Congr. Intern. Aeron., Paris, 6-8 Jun. 1979
(SNIAS-792-551-109) Avail: NTIS HC A02/MF A01

Standard metal testing procedures are reviewed, including ASTM tests for aluminum alloys. The use of data from these tests is discussed in terms of minimizing costs and enhancement of safety. Results from tests concerning the parameters K sub Ic, curve R, da/dN, and da/dt are presented. Author (ESA)

N80-26705# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
ON A PENALTY FUNCTION METHOD FOR THE SIMULATION OF MECHANICAL SYSTEMS SUBJECT TO CONTRAINTS
Per Loetstedt 1979 51 p refs Sponsored in part by Swed. Inst. of Appl. Math.
(TRITA-NA-7919) Avail: NTIS HC A04/MF A01

The mathematical properties of a penalty method for the digital simulation of mechanical systems of rigid bodies with constraints are investigated. The solutions of the systems of ordinary differential equations are expanded in Taylor series about a small parameter dependent on the penalty function. Under certain assumptions, the solution is close to that obtained by Lagrange multipliers. A Coulomb friction model is also presented and analyzed. This model has deficiences which are pointed out in two examples. Author (ESA)

N80-26706# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
A NUMERICAL METHOD FOR THE SIMULATION OF MECHANICAL SYSTEMS WITH UNILATERAL CONSTRAINTS
Per Loetstedt 1979 72 p refs Sponsored in part by Swed. Inst. of Appl. Math.
(TRITA-NA-7920) Avail: NTIS HC A04/MF A01

The simulation of the time dependent behavior of mechanical systems of rigid bodies on digital computers calls for the solution of second order ordinary differential equations with unilateral constraints. The underlying principle for the construction of the computational scheme is the Gaussian principle of least constraint. The Coulomb law of friction is modified slightly to allow an efficient solution of systems where such friction plays an important role. Limited computational experience is reported. Author (ESA)

N80-26707# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
ON THE NUMERICAL SIMULATION OF THE MOTION OF A SYSTEM OF RIGID BODIES SUBJECT TO VARIABLE CONSTRAINTS
Per Loetstedt 1979 11 p refs Sponsored in part by Swed. Inst. of Appl. Math.
(TRITA-NA-7922) Avail: NTIS HC A02/MF A01

A summary is presented of a thesis consisting of four separate papers on the simulation of mechanical systems with restraints, the use of penalty functions, numerical methods, and the interactive simulation of the progressive collapse of a building. Author (ESA)

N80-26708# Oxford Univ. (England). Dept. of Engineering Science.
INELASTIC BUCKLING OF COLUMNS PARTIALLY RESTRAINED AGAINST SWAY AND ROTATION
Giuseppe Oliveto 1979 26 p refs Sponsored in part by Transport and Road Res. Lab. and CNR
(OUEL-1298/79) Avail: NTIS HC A03/MF A01

A computer program is described for calculating the buckling load and the buckling shapes of columns restrained at intervals against sway and/or rotation by elastic springs. Beyond the elastic limit of the material, the analysis is performed by introducing the tangent modulus in a procedure similar to that of Engesser-Shanley for simple columns. The program is particularly suitable for a desk computer because of the very small amount of storage required. Some numerical results are presented. Author (ESA)

N80-26709# General Electric Co., Whetstone (England). Reactor Equipment Ltd.
INVESTIGATION OF THE FAILURE OF AN AC-3 CONDUCTION PUMP DUCT
G. Rowden Jun. 1979 15 p refs
(REL/R(79)27) Avail: NTIS HC A02/MF A01

The failure of the duct in an AC-3 conduction pump after 3,000 hours service at 350/400 C in a high temperature sodium circuit, was investigated. Examination shows that failure resulted from gross overheating and local melting of the duct wall. It is concluded that failure probably resulted from operating the pump outside the recommended regime. Author (ESA)

N80-26710# National Aerospace Lab., Amsterdam (Netherlands). Div. of Structures and Materials.
APPLICATION OF FINITE ELEMENT METHODS TO THE ANALYSIS OF CRACKS Final Report
G. Bartelds 1979 53 p refs
(Contract ESA-3411/77-NL-PP(SC))
(NLR-TR-79118-U; ESA-CR(P)-1311) Avail: NTIS HC A04/MF A01

The applicability of finite element methods to the analysis of cracks was studied. Methods available for the calculation of elastic stress intensity data for cracks of arbitrary shape using finite element techniques were evaluated. The indirect energy release method using virtual crack front variation is found to be the more efficient while the direct displacement extrapolation method is identified as a valuable backup procedure. Special automatic program control lists were then generated for the ASKA package to perform elastic energy release rate calculations. The use of modified elements to improve accuracy is explained and well documented benchmark problems are provided. The preferred procedures identified were applied to three different structural configurations. Experimental verification was provided by means of constant amplitude fatigue tests and residual strength tests. A calibrated relationship between the fatigue crack growth rate and the stress intensity variation during each cycle was used to generate stress intensity data. A comparison between fatigue data and ASKA results shows a rather close agreement, but the residual strength data shows a poor correlation.
Author (ESA)

N80-26358*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STRESS DISTRIBUTION IN A SEMI-INFINITE BODY SYMMETRICALLY LOADED OVER A CIRCULAR AREA
H. McGinness *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 123-130 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 20K

42 GEOSCIENCES (GENERAL)

N80-26711*# SRI International Corp., Menlo Park, Calif.
APPLICATION OF THE SRI CLOUD-TRACKING TECHNIQUE TO RAPID-SCAN GOES OBSERVATIONS Final Report, 5 Jun. 1978 - 30 Jan. 1980
Daniel E. Wolf and Roy M. Endlich Mar. 1980 34 p refs
(Contract NAS5-25027)
(NASA-CR-159989) Avail: NTIS HC A03/MF A01 CSCL 05B

An automatic cloud tracking system was applied to multilayer clouds associated with severe storms. The method was tested using rapid scan observations of Hurricane Eloise obtained by the GOES satellite on 22 September 1975. Cloud tracking was performed using clustering based either on visible or infrared data. The clusters were tracked using two different techniques. The data of 4 km and 8 km resolution of the automatic system yielded comparable in accuracy and coverage to those obtained by NASA analysts using the Atmospheric and Oceanographic Information Processing System. B.D.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-26712*# General Electric Co., Philadelphia, Pa. Space Div.
LANDSAT-2 AND LANDSAT-3 FLIGHT EVALUATION Report, 23 Jul. 1979 - 23 Jan. 1980
1 Feb. 1980 262 p ERTS
(Contract NAS5-21808)
(E80-10129; NASA-CR-159959; Doc-80SDS4200) Avail: NTIS HC A12/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26713*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE REMOTE SENSING OF SOIL MOISTURE CONTENT OVER BARE AND VEGETATED FIELDS 3
J. R. Wang, J. C. Shiue, and J. E. McMurtrey, III, Principal Investigators (Agr. Res. Center, Beltsville, Md.) Mar. 1980 16 p refs Submitted for publication ERTS
(E80-10123; NASA-TM-80669) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Ground truth of soil moisture content, and ambient air and soil temperatures were acquired concurrently with measurements of soil moisture in bare fields and fields covered with grass, corn, and soybeans obtained with 1.4 GHz and 5 GHz radiometers mounted on a truck. The biomass of the vegetation was sampled about once a week. The measured brightness temperatures over the bare fields were compared with those of radiative transfer model calculations using as inputs the acquired soil moisture and temperatures data with appropriate values of dielectric constants for soil-water mixtures. A good agreement was found between the calculated and measured results over 10 deg to 70 deg incident angles. The presence of vegetation reduced the sensitivity of soil moisture sensing. At 1.4 GHz the sensitivity reduction ranged from about 20% for 10 cm tall grassland cover to over 50 to 60% for the dense soybean field. At 5 GHz corresponding reduction in sensitivity ranged from approximately 70% to approximately 90%.

N80-26714*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
A METHODOLOGY FOR DETERMINING OPTIMUM MICROWAVE REMOTE SENSOR PARAMETERS
J. C. Holtzman, Principal Investigator and V. H. Kaupp Feb. 1980 200 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS9-15602)
(E80-10124; NASA-CR-160564; RSL-TR-380-1) Avail: NTIS HC A09/MF A01 CSCL 14B

There are no author-identified significant results in this report.

N80-26715*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
TEXAS NATURAL RESOURCES INVENTORY AND MONITORING SYSTEM (TNRIMS), APPLICATIONS SYSTEM VERIFICATION AND TRANSFER (ASVT), REMOTE SENSING INFORMATION SUBSYSTEM (RSIS): AS BUILT FUNCTIONAL DESIGN
M. L. Brown, A. M. Fails, M. V. Martin, A. S. Story, and E. A. Weisblatt, Principal Investigator Jan. 1980 115 p ERTS
(Contract NAS9-15800)
(E80-10125; NASA-CR-160561; LEMSCO-13258; JSC-16458) Avail: NTIS HC A06/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26716*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
CONTEXTUAL CLASSIFICATION OF MULTISPECTRAL IMAGE DATA
P. H. Swain, S. B. Vardeman, and J. C. Tilton, Principal Investigator 10 Jan. 1980 39 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Grant NSF MCS-78-04366; Proj. AgRISTARS)
(E80-10126; NASA-CR-160587; SR-PO-00443; LARS-TR-011080) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-26717*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONITORING FOREST CANOPY ALTERATION AROUND THE WORLD WITH DIGITAL ANALYSIS OF LANDSAT IMAGERY
Darrel L. Williams and Lee D. Miller, Principal Investigator (Texas A and M Univ., College Station) Aug. 1979 48 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10127; NASA-TM-80761) Avail: NTIS HC A03/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N80-26718*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
EVALUATION OF TRANSITION YEAR CANADIAN TEST SITES
R. W. Payne, Principal Investigators Apr. 1980 36 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10128; NASA-CR-160655; FC-L0-00422; LEMSCO-14320; JSC-16338) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. The spring small grain proportion accuracy in 15 Saskatchewan test sites was found to be comparable to that of the Large Area Crop Inventory Experiment Phase 3 and Transition Year results in the U.S. spring wheat states. Spring small grain labeling accuracy was 94%, and the direct wheat labeling accuracy was 89%, despite the low barley separation accuracy of 30%.

N80-26719*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
SOIL TEXTURAL EFFECTS ON RADAR RESPONSE TO SOIL MOISTURE
Fawwaz T. Ulaby, Principal Investigator and M. C. Dobson Oct. 1979 240 p refs ERTS
(Contract NAS9-14052)

(EB0-10131; NASA-CR-160585; RSL-TR-264-30) Avail: NTIS HC A11/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-26720*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN EXAMINATION OF SPECTRAL BAND RATIONING TO REDUCE THE TOPOGRAPHIC EFFECT ON REMOTELY SENSED DATA

Brent Holben and Chris Justice, Principal Investigator Feb. 1980 34 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(EB0-10133; NASA-TM-80640) Avail: NTIS HC A03/MF A01 CSCL 14E

There are no author-identified significant results in this report.

N80-26721*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

PHYSIOCHEMICAL, SITE, AND BIDIRECTIONAL REFLECTANCE FACTOR CHARACTERISTICS OF UNIFORMLY MOIST SOILS

Eric R. Stoner and Marion F. Baumgardner, Principal Investigator Feb. 1980 104 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15466; Proj. AgRISTARS)

(EB0-10134; NASA-CR-160571; SR-P0-00431; LARS-TR-11679) Avail: NTIS HC A06/MF A01 CSCL 02C

The author has identified the following significant results. The bidirectional reflectance factor (0.5 micron to 2.3 micron wavelength interval) and physiochemical properties of over 500 soils from 39 states, Brazil and Spain were measured. Site characteristics of soil temperature regime and moisture zone were used as selection criteria. Parent material and internal drainage were noted for each soil. At least five general types of soil reflectance curves were identified based primarily on the presence or absence of ferric iron absorption bands, organic matter content, and soil drainage characteristics. Reflectance in 10 bands across the spectrum was found to be negatively correlated with the natural log of organic matter content.

N80-26722*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

FOREST RESOURCE INFORMATION SYSTEM, PHASE 3 Quarterly Report, 1 Oct. - 31 Dec. 1979

R. P. Mroczynski, Principal Investigator, F. E. Goodrick, S. Schwingendorf, B. Shelley, D. Freeman, C. Kozlowski, C. Smith, and C. Peterson 20 Jan. 1980 65 p ERTS

(Contract NAS9-15325)

(EB0-10135; NASA-CR-160570; LARS-CR-012080) Avail: NTIS HC A04/MF A01 CSCL 20F

There are no author-identified significant results in this report.

N80-26723*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

CONTEXT DISTRIBUTION ESTIMATION FOR CONTEXTUAL CLASSIFICATION OF MULTISPECTRAL IMAGE DATA

J. C. Tilton, P. H. Swain, and S. B. Vardeman, Principal Investigator Apr. 1980 12 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15466; Proj. AgRISTARS)

(EB0-10136; NASA-CR-160588; SR-P0-00444; LARS-TR-040280) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-26724*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 1: SYSTEM OVERVIEW

P. J. Aucoin and J. Stewart, Principal Investigator Aug. 1978 226 p ERTS

(Contract NAS9-15200)

(EB0-10137; NASA-CR-160595; LEC-12563-Vol-1; JSC-13821-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26725*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 2: USER'S REFERENCE MANUAL

P. J. Aucoin, Principal Investigators and J. Stewart Dec. 1978 307 p refs ERTS

(Contract NAS9-15200)

(EB0-10138; NASA-CR-160594; LEC-12564-Vol-2; JSC-13821-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26726*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

EARTH OBSERVATIONS DIVISION VERISON OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 4: PROGRAM LISTINGS

M. L. Burnell and P. J. Aucoin, Principal Investigator Jan. 1979 527 p ERTS

(Contract NAS9-15800)

(EB0-10139; NASA-CR-160592; LEC-12565-Vol-4; JSC-13821-Vol-4) Avail: NTIS HC A23/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26727*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 4: PROGRAM LISTINGS

M. L. Burnell and P. J. Aucoin, Principal Investigator Nov. 1979 535 p Revised ERTS

(Contract NAS9-15800)

(EB0-10140; NASA-CR-160572; LEC-12566-Rev-A; JSC-13821-Rev-A) Avail: NTIS HC A23/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26728*# London Univ. (England). Dept. of Geography.

HCMM AND LANDSAT IMAGERY FOR GEOLOGICAL MAPPING IN NORTHWEST QUEENSLAND

M. M. Cole and D. J. Edmiston, Principal Investigator [1980] 7 p refs Sponsored by NASA HCMM

(EB0-10141; NASA-CR-163159) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Photographic prints made from negatives of day-visible and day-IR cover of selected areas were compared with enhanced color composites generated from LANDSAT computer compatible tapes and films. For geological mapping purposes, HCMM imagery is of limited value. While large scale features like the Mitakoodi anticlinorium, contrasting lithological units, and major structures may be distinguished on day-visible and day-IR cover, the spectral bands are too broad and the resolution too coarse even for regional mapping purposes. The imagery appears to be most useful for drainage studies. Where drainage is seasonal, sequential imagery permits monitoring of broad scale water movement while the day-IR imagery yields valuable information on former channels. In plains areas subject to periodic change of stream courses, comparable IR cover at a larger scale would offer considerable potential for reconstruction of former drainage patterns essential for the correct interpretation of geochemical data relative to mineral exploration.

N80-26729*# London Univ. (England).

HCMM IMAGERY FOR THE DISCRIMINATION OF ROCK

TYPES, THE DETECTION OF GEOTHERMAL ENERGY SOURCES AND THE ASSESSMENT OF SOIL MOISTURE CONTENT IN WESTERN QUEENSLAND AND ADJACENT PARTS OF NEW SOUTH WALES AND SOUTH AUSTRALIA
Progress Report
Monica M. Cole, Principal Investigator 28 Feb. 1980 5 p Sponsored by NASA HCMM
(E80-10142; NASA-CR-163160) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Day-visible and day-IR imagery of northwest Queensland show that large scale geological features like the Mitakoodi anticlinorium, which involves rocks of contrasting lithological type, can be delineated. North of Cloncurry, the contrasting lithological units of the Knapdale quartzite and bedded argillaceous limestones within the Proterozoic Corella sequence are clearly delineated in the area of the Dugald River Lode. Major structural features in the Mount Isa area are revealed on the day-visible cover which provides similar but less detailed information than the LANDSAT imagery. The day-IR cover provides less additional information for areas of outcropping bedrock than had been expected. Initial studies of the day-IR and night-IR cover for parts of South Australia suggest that they contain additional information on geology compared with day-visible cover.

N80-26730*# Bureau de Recherches Geologiques et Minieres, Orleans (France).
SPATIAL THERMAL RADIOMETRY CONTRIBUTION TO THE MASSIF ARMORICAIN AND THE MASSIF CENTRAL (FRANCE) LITHO-STRUCTURAL STUDY Progress Report, Aug. 1979 - Feb. 1980
Jean-Yves Scanvic, Principal Investigator Mar. 1980 25 p refs Sponsored by NASA and CNES HCMM
(E80-10143; NASA-CR-163161) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. Although the limited number of images received did not permit construction of a thermal inertia map, important geological details were obtained in the areas of lithology and tectonics. Interpretation of day, night, and seasonal imagery resulted in differentiating broad calcareous and dolomitic units in the Causse Plateau. In the Massif amoricain, some granite massifs were delineated which were not observed by LANDSAT. Neotectonic faults were also revealed.

N80-26731*# National Environmental Satellite Service, Washington, D. C.
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 31 Mar. 1980 3 p Sponsored by NASA HCMM
(E80-10144; NASA-CR-163162) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N80-26732*# Environmental Research and Technology, Inc., Concord, Mass.
INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, 1 Jan. - 31 Mar. 1980
James C. Barnes, Principal Investigator Apr. 1980 17 p HCMM
(Contract NAS5-24316)
(E80-10145; NASA-CR-163163; QPR-10) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. Analysis of HCMM digital thermal data for daytime passes over the Salt-Verde Watershed area on five dates show a gradual depletion of snow cover in the watershed (and in the Little Colorado Watershed to the north) from a maximum on February 9th to a nearly complete disappearance of the snow pack by April 15th. Temperature contours correspond closely with the snowline observed in the visible image.

N80-26733*# Telespazio, S.p.A., Rome (Italy).
GREEN AND SOIL BRIGHTNESS INDICATORS OBTAINED THROUGH A LANDSAT DATA TRANSFORMATION PROCEDURE
Angelo Zandonella, Principal Investigator 1980 11 p refs Presented at the 27th Rass. Intern. Elettronica Nucl. ed Aerospaziale, Rome, 7-16 Mar. 1980 and the 20th Convegno sulla Spazio, Rome, 11-13 Mar. 1980 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10146; NASA-CR-163164) Avail: NTIS HC A02/MF A01 CSCL 14E

There are no author-identified significant results in this report.

N80-26734*# Geological Survey, Denver, Colo.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, Dec. 1979 - Feb. 1980
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Feb. 1980 3 p Sponsored by NASA HCMM
(E80-10147; NASA-CR-163165) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N80-26735*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
LABEL IDENTIFICATION FROM STATISTICAL TABULATION (LIST) TEMPORAL EXTENDABILITY STUDY
T. B. Dennis, Principal Investigator Feb. 1980 37 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10148; NASA-CR-160563; SR-LO-00424; LEMSCO-14278; JSC-16334) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. The most apparent contributors to the problem of poor temporal extension of LIST are the drastic changes in the brightness keys and an inadequate set of AI responses in Phase 3. The brightness trajectories change drastically from Phase 3 to the transition year (TY). Removing brightness channels from the discriminant does not completely correct the lack of extendability. Removing brightness increases the accuracy of the extension from Phase 3 to TY from 57.7 percent to 64.18 percent. The removal of the AI keys increases accuracy to 65.76 percent. Although the latter increase appears insignificant when compared to the first, the removal of only the AI keys increased accuracy to 63.58 percent. Proper weighting of the responses explains 73.8 percent of the ground truth labels but only 56.7 percent of the AI labels. By contrast, the TY responses which were weighted to explain the TY ground truth labels fared equally well, explaining 73.6 percent of those labels and 87.1 percent of the AI labels.

N80-26736*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report
Toby N. Carlson, Principal Investigator 1 Jun. 1980 4 p HCMM
(Contract NAS5-24264)
(E80-10150; NASA-CR-163167; QR-10) Avail: NTIS HC A02/MF A01 CSCL 13B

There are no author-identified significant results in this report.

N80-26737*# Environmental Research Inst. of Michigan, Ann Arbor.
LANDSAT TECHNOLOGY TRANSFER USING COMMUNITY COLLEGES Progress Report, Jan. - Apr. 1980
Robert H. Rogers, Principal Investigator May 1980 48 p ERTS
(Contract NASw-3308)
(E80-10154; NASA-CR-163171; ERIM-147200-4-P) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-26738*# South Dakota State Univ., Brookings. Remote Sensing Inst.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Progress Report, Jan. - Mar. 1980
Donald G. Moore, Principal Investigator and J. L. Heilman Mar. 1980 7 p HCMM
(Contract NAS5-24206)
(E80-10155; NASA-CR-163172; SDSU-RSI-80-03) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. Day thermal data were analyzed to assess depth to groundwater in the test site. HCMM apparent temperature was corrected for atmospheric effects using lake temperature of the Oahe Reservoir in central South Dakota. Soil surface temperatures were estimated using an equation developed for ground studies. A significant relationship was found between surface soil temperature and depth to groundwater, as well as between the surface soil-maximum air temperature differential and soil water content (% of field capacity) in the 0 cm and 4 cm layer of the profile. Land use for the data points consisted of row crops, small grains, stubble, and pasture.

N80-26739*# Instituto Geografico Nacional, Madrid (Spain).
THERMAL MAPPING, GEOTHERMAL SOURCE LOCATION, NATURAL EFFLUENTS AND PLANT STRESS IN THE MEDITERRANEAN COAST OF SPAIN Progress Report
Rodolfo Nunez delasCuevas, Principal Investigator, Fernando Lopez Segredo, Joaquin Melia Miralles, Pedro Herranz Araujo, Jesus Paredes Perlado, D. Antonio Parrilla, D. J. Luis Piecon, D. J. Luis Labrandero, and F. Gonzalez Bernaldez 31 Dec. 1979 41 p refs Sponsored by NASA Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E80-10156; NASA-CR-163173; PR-2) Avail: NTIS HC A03/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-26740*# Texas A&M Univ., College Station. Remote Sensing Center.
DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Progress Report
W. D. Rosenthal, J. C Harlan, and Bruce J. Blanchard, Principal Investigator Feb. 1980 24 p Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(Contract NAS5-24383)
(E80-10157; NASA-CR-163174; PR-3712-8) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-26741*# Dartmouth Coll., Hanover, N.H.
AN INVESTIGATION OF VEGETATION AND OTHER EARTH RESOURCE/FEATURE PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA. A: LANDSAT. B: REMOTE SENSING OF VOLCANIC EMISSIONS Semiannual Status Report, 1 Jul. - 31 Dec. 1979
Richard W. Birnie, Richard E. Stoiber, Principal Investigator, Emily Bryant, A. G Dodge, Ken Sutherland, Joseph Francica, and Lawrence Malinconico 31 Dec. 1979 27 p ERTS
(Grant NaG-5014)
(E80-10158; NASA-CR-163177) Avail: NTIS HC A03/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-26742*# Montana Univ., Missoula. Wildlife-Wildlands Inst.
GRIZZLY BEAR HABITAT ANALYSIS. SECTION 2: EVALUATION OF GRIZZLY BEAR FOOD PLANTS, FOOD CATEGORIES AND HABITAT
John J. Craighead and Jay S. Sumner, Principal Investigator 1980 172 p refs Sponsored by NASA ERTS
(E80-10159; NASA-CR-163175) Avail: NTIS HC A08/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-26743*# Applied Science Associates, Inc., Apex, N. C.
A STUDY OF GEOS-3 TERRAIN DATA WITH EMPHASIS ON RADAR CROSS SECTION Final Report
R. W. Priester May 1980 53 p refs
(Contract NAS6-2810)
(NASA-CR-156865) Avail: NTIS HC A04/MF A01 CSCL 08B

Radar cross sections (RCS) of terrain are studied using GEOS 3 radar altimeter data. Maps of RCS for portions of four east coast states (U.S.A.) are presented and used to draw curves of RCS versus inland distance as measured from the land/sea interface. The results show RCS to decay approximately exponentially with inland distance. The GEOS 3 data are also used to develop curves of RCS seasonal variation for the same regions. Observed variations correlate strongly with local potential evaporation. Results also show that farming operations in the state of North Carolina are observable in the RCS data. A restricted method for determining surface roughness features from saturated average return waveforms for some types of terrain is developed. Sensor bias induced by receiver saturation for certain terrain returns is briefly discussed. J.M.S.

N80-26744*# General Electric Co., Philadelphia, Pa.
ASSESSMENT OF THE USE OF SPACE TECHNOLOGY IN THE MONITORING OF OIL SPILLS AND OCEAN POLLUTION: EXECUTIVE SUMMARY
U. R. Alvarado, ed. Apr. 1980 68 p
(Contract NAS1-15657)
(NASA-CR-159243) Avail: NTIS HC A04/MF A01 CSCL 13B

The adequacy of current technology in terms of stage of maturity, of sensing, support systems, and information extraction was assessed relative to oil spills, waste pollution, and inputs to pollution trajectory models. Needs for advanced techniques are defined and the characteristics of a future satellite system are determined based on the requirements of U.S. agencies involved in pollution monitoring. A.R.H.

N80-26745*# General Electric Co., Philadelphia, Pa. Space Div.
ASSESSMENT OF THE USE OF SPACE TECHNOLOGY IN THE MONITORING OF OIL SPILLS AND OCEAN POLLUTION: TECHNICAL VOLUME. EXECUTIVE SUMMARY
U. R. Alvarado, ed., G. Chafaris, J. Chestek, J. Contrad, G. Frippel, R. Gulatsi, A. Heath, H. Hodara (Tetra Tech., Inc., Pasadena, Calif.), H. Kritikos (Pennsylvania Univ., Philadelphia), and K. Tamiyasu Apr. 1980 464 p refs
(Contract NAS1-15657)
(NASA-CR-159242; Doc-80SDS4203) Avail: NTIS HC A20/MF A01 CSCL 13B

The potential of space systems and technology for detecting and monitoring ocean oil spills and waste pollution was assessed as well as the impact of this application on communication and data handling systems. Agencies charged with responsibilities in this area were identified and their measurement requirements were ascertained in order to determine the spatial resolution needed to characterize operational and accidental discharges. Microwave and optical sensors and sensing techniques were evaluated as candidate system elements. Capabilities are described for the following: synthetic aperture radar, microwave scatterometer, passive microwave radiometer, microwave altimeter, electro-optical sensors currently used in airborne detection, existing space-based optical sensors, the thematic mapper, and the pointable optical linear array. A.R.H.

N80-26746*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
MICROWAVE REMOTE SENSING OF SNOWPACKS Final Report
William H. Stiles and Fawaz T. Ulaby Jun. 1980 438 p refs
(Contract NAS5-23777)
(NASA-CR-3263) Avail: NTIS HC A19/MF A01 CSCL 08L

The interaction mechanisms responsible for the microwave backscattering and emission behavior of snow were investigated, and models were developed relating the backscattering coefficient (sigma) and apparent temperature (T) to the physical parameters of the snowpack. The microwave responses to snow wetness, snow water equivalent, snow surface roughness, and to diurnal variations were investigated. Snow wetness was shown to have an increasing effect with increasing frequency and angle of incidence for both active and passive cases. Increasing snow wetness was observed to decrease the magnitude sigma and increase T. Snow water equivalent was also observed to exhibit a significant influence sigma and T. Snow surface configuration (roughness) was observed to be significant only for wet snow surface conditions. Diurnal variations were as large as 15 dB for sigma at 35 GHz and 120 K for T at 37 GHz. Simple models for sigma and T of a snowpack scene were developed in terms of the most significant ground-truth parameters. The coefficients for these models were then evaluated; the fits to the sigma and T measurements were generally good. Finally, areas of needed additional observations were outlined and experiments were specified to further the understanding of the microwave-snowpack interaction mechanisms. A.R.H.

N80-26747# Geological Survey, Anchorage, Alaska.
THE UNITED STATES GEOLOGICAL SURVEY IN ALASKA, 1979 PROGRAMS
Katherine M. Reed, ed. 1979 100 p
(Circ-804-A) Avail: NTIS HC A05/MF A01

A survey of programs designed to identify the land, water, energy, and mineral resources of Alaska is presented. Emphasis is placed on demonstrating how the needs of both conservation and development can be met. Classification of federally owned mineral lands and water-power sites, the exploration and development of energy and natural resources on Federal and Indian lands, and the exploration and appraisal of the petroleum potential of the National Petroleum Reserve in Alaska are among the topics discussed. Regional geology, economic geology, stratigraphy, paleontology, hydrology, marine geology, and engineering and environmental geology are included. J.M.S.

N80-26748# Geological Survey, Washington, D. C.
INTRODUCTION TO MONITORING DYNAMIC ENVIRONMENTAL PHENOMENA OF THE WORLD USING SATELLITE DATA COLLECTION SYSTEMS, 1978
William D. Carter and Richard W. Paulson 1979 26 p refs
(Circ-803) Avail: NTIS HC A03/MF A01

Satellite telemetry systems that can collect and transmit environmental data from remote regions of the world to regional resources information centers are described. The features and limitations of global information systems are discussed with respect to instrumentation. R.C.T.

N80-26749# Central Intelligence Agency, Washington, D.C.
THE WORLD OIL MARKET IN THE YEARS AHEAD: A RESEARCH PAPER
Aug. 1979 87 p
(ER-79-10327U) Avail: NTIS HC A05/MF A01

A review of the oil market before 1973, during the period 1973 to 1978, and at the present time is given. The outlook for the world oil market over the next several years is analyzed. Oil production in the industrial countries, supplies from the developing countries, net exports from communist countries, and OPEC supplies are discussed. Alternative energy sources and the energy supply outlook for OECD countries are also considered. Other topics covered are factors affecting demand, the future energy market, and oil supplies in the long term. J.M.S.

N80-26750*# Miami Univ., Coral Gables, Fla. School of Engineering and Architecture.
THREE DIMENSIONAL THERMAL POLLUTION MODELS. VOLUME 1: REVIEW OF MATHEMATICAL FORMULATIONS Final Report
Samuel S. Lee and Subrata Sengupta May 1978 202 p refs 3 Vol.
(Contract NAS10-8926)
(NASA-CR-154624-Vol-1; KSC-TR-43-2-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 13B

A mathematical model package for thermal pollution analyses and prediction is presented. These models, intended as user's manuals, are three dimensional and time dependent using the primitive equation approach. Although they have sufficient generality for application at sites with diverse topographical features; they also present specific instructions regarding data preparation for program execution and sample problems. The mathematical formulation of these models is presented including assumptions, approximations, governing equations, boundary and initial conditions, numerical method of solution, and same results. J.M.S.

N80-26751*# Miami Univ., Coral Gables, Fla. School of Engineering and Architecture.
THREE DIMENSIONAL THERMAL POLLUTION MODELS. VOLUME 2: RIGID-LID MODELS Final Report
Samuel S. Lee and Subrata Sengupta May 1978 364 p 3 Vol.
(Contract NAS10-8926)
(NASA-CR-154624-Vol-2; KSC-TR-43-2-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 13B

Three versions of rigid lid programs are presented: one for near field simulation; the second for far field unstratified situations; and the third for stratified basins, far field simulation. The near field simulates thermal plume areas, and the far field version simulates larger receiving aquatic ecosystems. Since these versions have many common subroutines, a unified testing is provided, with main programs for the three possible conditions listed. J.M.S.

N80-26752*# Miami Univ., Coral Gables, Fla. School of Engineering and Architecture.
THREE DIMENSIONAL THERMAL POLLUTION MODELS. VOLUME 3: FREE SURFACE MODELS Final Report
Samuel S. Lee and Subrata Sengupta May 1978 231 p 3 Vol.
(Contract NAS10-8926)
(NASA-CR-154624-Vol-3; KSC-TR-43-2-Vol-3) Avail: NTIS HC A11/MF A01 CSCL 13B

Two sets of programs, named Nasum 2 and Nasum 3 are presented in detail. Nasum 2 is a far field formulation and is used without including the plant thermal discharge. Nasum 3 uses horizontal stretching to provide higher resolution at thermal discharge joints; and includes far field influences such as varying tides and ambient currents far from point of discharge. J.M.S.

N80-26753# Phoenix Corp., McLean, Va.
AN OVERVIEW OF THE EXTERNAL MAGNETIC FIELD WITH REGARD TO MAGNETIC SURVEYS Interim Report, May - Oct. 1979
Robert D. Regan and Paul Rodriguez 1 Oct. 1979 72 p refs
(Contract N00014-79-C-0409)
(AD-A083227) Avail: NTIS HC A04/MF A01 CSCL 08/14

This report sponsored by the Earth Physics Program of the Office of Naval Research, is an attempt to bring together in a coherent manner, for those involved in magnetic surveys, the relevant aspects of the external geomagnetic field. Although there are several excellent introductory texts on geomagnetism that treat much of this subject (most notably, Sugiura and Heppner, 1968; and Knecht, 1972) it was thought that there was a need to condense and present this and other supportive material in a form that would be more applicable to the objectives of magnetic surveys, as there is considerable interest in correcting magnetic surveys for the effects of the external field. Such efforts must start with a sufficiently detailed understanding of the geomagnetic environment in which magnetic survey data are collected and particularly of the various external field sources. Hopefully this report will serve to provide such an understanding. GRA

N80-26754# Pennzoil Co., Vienna, W. Va.
OIL RECOVERY BY CARBON DIOXIDE INJECTION Annual Report, Jul. 1978 - Jun. 1979

Paul E. King Nov. 1979 57 p
(Contracts EF-76-C-05-5301; DE-AC21-76MC-05301)
(ORO-5301-47) Avail: NTIS HC A04/MF A01

After one year of response, the increase in production due to waterflooding ended by December, 1978. The total production credited to the waterflood process was 10,403 barrels or 529 barrels per acre. Less than one month after limited carbon dioxide injection began, a high carbon dioxide content was found in the produced gas at Shaffer No. 1, apparently as a result of channeling through the Big Lime thief zone. In April, the carbon dioxide injection rate was reduced to a total of 90 tons per day in an attempt to increase the effective injection from 26.7% to the designed 50%. The net carbon dioxide injection was 10,595.50 tons on July 1, 1979, 42.3% of the total to be injected. DOE

N80-26755# World Meteorological Organization, Geneva (Switzerland).
APPLICATIONS OF REMOTE SENSING TO HYDROLOGY
R. D. Wiesnet, V. G. Konovalov, and S. I. Solomon 1979 62 p refs
(WMO-513; ISBN-92-62-10513-8) Avail: NTIS HC A04/MF A01; WMO, Geneva SWFR 10

The application of remote sensing to the collection of data on surface waters and related water balance elements is considered. The principles and techniques used are reviewed and the nature of the results obtained and their application are discussed. The various types of sensor, data-transmission systems and remote-sensing platforms which are used to obtain data on different hydrological elements are described. The practical application of remote sensing of surface water, lakes, snow, glaciers, precipitation and soil moisture is discussed. Subjects such as the use of meteorological radar of natural gamma radiation for remote sensing are dealt with to a limited extent. To determine the state-of-the-art in remote sensing of hydrological elements, a questionnaire was sent to selected members on WMO. A summary of the individual replies to this questionnaire is appended. Author (ESA)

N80-26756# New York State Museum and Science Service, Albany.
AN EVALUATION OF THE IMPACT OF NATURAL RESOURCE INFORMATION ON LAND-USE DECISION MAKERS Final Report
James F. Davis, Robert Fakundiny, Richard Monheimer, Edgar Reilly, and Cathy A. Chazen 1 Jan. 1979 158 p refs
(Grant NSF DSI-75-12769)
(PB80-149131; NYSGS-79-0605-F) Avail: NTIS HC A08/MF A01 CSCL 13B

The effectiveness of natural resource data products on the governmental decision-making process was evaluated. Hartford, Connecticut and Syracuse, New York were studied to determine the most effective means for transmitting information from data producers to users, determine natural resource characteristics considered most significant by producers and users, and evaluate whether the effectiveness of data production and public land-use decisions can be determined. GRA

N80-26757# New York State Museum and Science Service, Albany.
AN EVALUATION OF THE IMPACT OF NATURAL RESOURCES INFORMATION ON LAND-USE DECISION MAKERS. APPENDICES 1-7 Final Report
James F. Davis, Robert Fakundiny, Richard Monheimer, Edgar Reilly, Cathy A. Chazen, Deborah G. Roach, Barbara A. Beberwych, Thomas Triscari, Elizabeth Mikols, and Mark Rappaport 1 Jan. 1979 291 p refs
(Grant NSF DSI-15-12769)
(PB80-149149; NYSGS-79-0605-App) Avail: NTIS HC A13/MF A01 CSCL 13B

Assessment of the effectiveness of natural resource data products on the governmental decision-making process in Hartford, Connecticut and Syracuse, New York suggests that all data producers should undertake an evaluation of users needs before designing the product. The basic questions to be asked are provided and product characteristics that should be considered are suggested. The information flow-system through which the products pass should be defined and translator/advisors should be identified and questioned. GRA

N80-26758# New Mexico Univ., Albuquerque.
REMOTE SENSING: PHOTOINTERPRETATION TECHNIQUES OF LANDSAT DATA. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1977 - Jan. 1980
Robert W. Gonzales Mar. 1980 40 p Sponsored in cooperation with NASA and NTIS
(PB80-805484) Avail: NTIS HC $30.00/MF $30.00 CSCL 14E

Various aspects of photointerpretation of LANDSAT data are considered in 152 abstracts of reports on photomapping, geologic and soil investigations, effect of vegetation on rock and soil, ecological land classification, forestry, terrain and crop analysis, and additive viewing as an interpretation technique. GRA

N80-26759# South Carolina Land Resources Conservation Commission, Columbia.
APPLICATION OF SATELLITE DATA TO SURFACE MINE MONITORING IN SELECTED COUNTIES OF SOUTH CAROLINA Final Report, Sep. 1977 - Sep. 1978
James N. Bayne and Hewson Lawrence Mar. 1979 141 p refs
(Grant DI-BM-G0-177166)
(PB80-144629; BM-OFR-11-80) Avail: NTIS HC A07/MF A01 CSCL 08I

The LANDSAT data from computer compatible tapes were used to explore the capability of LANDSAT digital imagery to monitor mining and reclamation activity in several South Carolina mining operations. Differentiation between active-spoil-partially and completely reclaimed areas was successfully demonstrated including small mining operations of less than 30 acres. GRA

N80-26760# National Weather Service, Salt Lake City, Utah. Hydrology Div.
OCCURRENCE AND DISTRIBUTION OF FLASH FLOODS IN THE WESTERN REGION
Thomas L. Dietrich Dec. 1979 53 p refs
(PB80-160344; NOAA-TM-NWS-WR-147; NOAA-80012202)
Avail: NTIS HC A04/MF A01 CSCL 08H

Flash floods that have occurred in the western United States as reported in the U.S. Geological Survey Annual Flood Summaries from 1950 to 1969 are described. GRA

N80-26761# Colorado Univ., Boulder.
NONSTRUCTURAL FLOODPLAIN MANAGEMENT STUDY: OVERVIEW
Gilbert F. White 1 Oct. 1979 14 p Sponsored in part by Water Resources Council, Washington, D. C.
(PB80-158538) Avail: NTIS HC A02/MF A01 CSCL 08H

Impediments to Federal sponsorship of nonstructural measures for flood plain management are discussed. GRA

N80-26762# Tetra Tech, Inc., Lafayette, Calif.
SEDIMENT-POLLUTANT RELATIONSHIPS IN RUNOFF FROM SELECTED AGRICULTURAL, SURBURBAN, AND URBAN WATERSHEDS. A STATISTICAL CORRELATION STUDY Final Report, Sep. 1977 - Sep. 1978
Stanley W. Zison Jan. 1980 150 p refs
(Contract EPA-68-03-2611)
(PB80-158108; EPA-600/3-80-022) Avail: NTIS HC A07/MF A01 CSCL 08H

Data from agricultural, surburban, and urban watersheds were subjected to statistical correlation analysis to estimate potency factors. These factors were coefficients that, when multiplied by sediment mass emission rates (transported in runoff), provide esimates of mass emission rates for other pollutants. The data were also subjected to multiple regression analysis to examine the effect of storm parameters on runoff water quality and the interrelationship among runoff water quality constituent concentrations themselves (other than sediment load). GRA

N80-26763# California Univ., Los Angeles. School of Engineering and Applied Science.
BENEFITS OF LONG-RANGE STREAMFLOW PREDICTION
William W-G. Yeh, Leonard Becker, Marvin J. Cohn (Calif. State

Dept. of Water Resources), and Robert Zettlemoyer Feb. 1980 38 p refs Sponsored in part by Calif. State Dept. of Water Resources, Sacramento
(PB80-156276; Contrib-181; ISSN-0575-4941) Avail: NTIS HC A03/MF A01 CSCL 08H

Improved benefits that might be gained from the use of long range stream flow forecasts in the operation of a typical multipurpose reservoir are assessed. Long range is defined as a period of time ranging from one month to one year. The Oroville-Thermalito reservoir system is selected for study. Major benefits to be derived from long term stream flow prediction for this system are hydropower generation, water conservation for irrigation and/or other beneficial uses, and decreased seepage damage to crops. Flood control benefits are potentially high but those benefits are more amenable to short term rather than long term forecasting. The reservoir is theoretically operated over the 1914 to 1973 time period. GRA

N80-27099# International Training Centre for Aerial Survey, Enschede (Netherlands).
DIGITAL IMAGE PROCESSING OF SATELLITE PHOTOGRAPHS [DIGITALE BEELDVERWERKING VAN SATELLIET OPNAMEN]
Nico H. W. Donker *In* Amsterdam Univ. The Computer in Phys. Geograph. 1979 p 35-61 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-26764* National Aeronautics and Space Administration, Washington, D. C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Apr. 1980 408 p
(NASA-SP-7043(25)) Avail: NTIS HC A18 CSCL 10B

This bibliography lists 1428 reports, articles, and other documents introduced into the NASA scientific and technical information system from January 1, 1980 through March 31, 1980. Author

N80-26765# Gulf Research and Development Co., Pittsburgh, Pa.
REFINERY ENERGY PROFILE: USER'S GUIDE
R. W. Maier, W. P. Olivent, D. L. Brandt, and T. G. Golden Jan. 1979 146 p
(Contract EY-77-C-05-5262)
(ORO-5262-6) Avail: NTIS HC A07/MF A01

The step by step procedure that was developed for preparing energy profiles at any refinery is described. The technique is presented in four parts covering preparation, data gathering, performing calculations and preparing the profiles. Rigorous calculation procedures are used that require the collection of substantial amounts of data and in some cases use commercially available computer programs. Since situations can arise where the data required for rigorous procedures or computer programs cannot be obtained, alternate calculation procedures are given which can be used when some sacrifice in accuracy is justifiable and acceptable. R.E.S.

N80-26766*# Travis-Braun and Associates, Inc., Dallas, Tex.
SOLAR ENERGY FACILITY AT NORTH HAMPTON RECREATION CENTER, DALLAS, TEXAS Final Report
May 1980 141 p
(Contract EX-76-C-01-2543)
(NASA-CR-161444) Avail: NTIS HC A07/MF A01 CSCL 10A

The solar energy facility located at the North Hampton Park Recreation and Health Center, Dallas, Texas is presented. The solar energy system is installed in a single story (two heights), 16,000 sq ft building enclosing a gymnasium, locker area, and health care clinic surrounded by a recreational area and athletic field. The solar energy system is designed to provide 80 percent of the annual space heating, 48 percent of the annual space cooling, and 90 percent of the domestic hot water requirements. The system's operation modes and performance data acquisition system are described. The system's performance during the months of June, July, August, September, and October of 1979 are presented and show a negative savings of energy. Experience to date indicates however that the system concept has promise of acceptable performance. It is concluded that if proper control and sequencing components was maintained, then the system performance would improve to an acceptable level. R.E.S.

N80-26767*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CHARACTERIZATION OF SOLAR CELLS FOR SPACE APPLICATIONS. VOLUME 13: ELECTRICAL CHARACTERISTICS OF HUGHES LPE GALLIUM ARSENIDE SOLAR CELLS AS A FUNCTION OF INTENSITY AND TEMPERATURE
B. E. Anspaugh, D. M. Beckert, R. G. Downing, T. F. Miyahira, and R. S. Weiss 1 Jun. 1980 40 p
(Contract NAS7-100)
(NASA-CR-163025; JPL-Pub-78-15-Vol-13) Avail: NTIS HC A03/MF A01 CSCL 10A

Electrical characteristics of Hughes Liquid phase epitaxy, P/N gallium aluminum arsenide solar cells are presented in graphical and tabular format as a function of solar illumination intensity and temperature. Author

N80-26768*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PHOTOVOLTAIC RESIDENTIAL APPLICATIONS PROGRAM IMPLEMENTATION WORKSHOP PROCEEDINGS
R. H. Barbieri 15 May 1980 168 p Workshop held at Calif. Inst. of Tech., Pasadena, 12-13 Feb. 1980
(Contract NAS7-100; EX-76-A-29-1012)
(NASA-CR-163274; JPL-Pub-80-22) Avail: NTIS HC A08/MF A01 CSCL 10B

Two major aspects of the workshop are presented: (1) presentations on the Photovoltaic program and the National Solar Heating and Cooling Demonstration program, and (2) discussions on the issues pertinent to the Residential Application program. R.E.S.

N80-26769*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Solar Thermal Power Systems Project.
COST AND PRICE ESTIMATE OF BRAYTON AND STIRLING ENGINES IN SELECTED PRODUCTION VOLUMES
H. R. Fortgang and H. F. Mayers 31 May 1980 16 p
(Contracts NAS7-100; DE-AI01-79ET-20397; JPL Proj. 5105-29)
(NASA-CR-163265; DOE/JPL-1060/35; JPL-Pub-80-42) Avail: NTIS HC A02/MF A01 CSCL 10B

The methods used to determine the production costs and required selling price of Brayton and Stirling engines modified for use in solar power conversion units are presented. Each engine part, component and assembly was examined and evaluated to determine the costs of its material and the method of manufacture based on specific annual production volumes. Cost estimates are presented for both the Stirling and Brayton engines in annual production volumes of 1,000, 25,000, 100,000 and 400,000. At annual production volumes above 50,000 units, the costs of both engines are similar, although the Stirling engine costs are somewhat lower. It is concluded that modifications to both the Brayton and Stirling engine designs could reduce the estimated costs. R.E.S.

N80-26770*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THERMAL POWER SYSTEMS (TPS); POINT-FOCUSING THERMAL AND ELECTRIC APPLICATIONS (PFTEA).

VOLUME 2: DETAILED REPORT, FISCAL YEAR 1979
15 Jan. 1980 146 p refs
(Contracts NAS7-100; Contract DE-AI01-79ET-20397)
(NASA-CR-163023; DOE/JPL-1060/31-Vol-2; JPL-Pub-79-118-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 10A

Progress in the development of systems which employ point focusing distributed receiver technology is reported. Emphasis is placed on the first engineering experiment, the Small Community Solar Thermal Power Experiment. Procurement activities for the Military Module Power Experiment the first of a series of experiments planned as part of the Isolated Load Series are included. J.M.S.

N80-26771*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COST OF CZOCHRALSKI WAFERS AS A FUNCTION OF DIAMETER
M. H. Leipold, C. Radics, and A. Kachare 15 Feb. 1980 20 p
(Contracts NAS7-100; EX-76-A-29-1012)
(NASA-CR-163277; DOE/JPL-1012/37; JPL-Pub-80-25) Avail: NTIS HC A02/MF A01 CSCL 10A

The impact of diameter in the range of 10 to 15 cm on the cost of wafers sliced from Czochralski ingots was analyzed. Increasing silicon waste and decreasing ingot cost with increasing ingot size were estimated along with projected costs. Results indicate a small but continuous decrease in sheet cost with increasing ingot size in this size range. Sheet costs including silicon are projected to be $50 to $60/sq m (1980 $) depending upon technique used. R.E.S.

N80-26772*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOTHERMAL DIRECT HEAT USE: MARKET POTENTIAL/ PENETRATION ANALYSIS FOR FEDERAL REGION 9
William Powell, ed. and Kenneth Tang, ed. May 1980 337 p
(Contract NAS7-100)
(NASA-CR-163267; JPL-Pub-80-41) Avail: NTIS HC A15/MF A01 CSCL 10B

A preliminary study was made of the potential for geothermal direct heat use in Arizona, California, Hawaii, and Nevada (Federal Region 9). An analysis was made of each state to: (1) define the resource, based on the latest available data; (2) assess the potential market growth for geothermal energy; and (3) estimate the market penetration, projected to 2020. Findings of the study include the following: (1) Potentially economical hydrothermal resources exist in all four states of the Region; however, the resource data base is largely incomplete, particularly for low to moderate temperature resources. (2) In terms of beneficial heat, the total hydrothermal resource identified so far for the four states is on the order of 43 Quads, including an estimated 34 Quads of high temperature resources which are suitable for direct as well as electrical applications. (3) In California, Hawaii, and Nevada, the industrial market sector has somewhat greater potential for penetration than the residential/commercial sector. In Arizona, however, the situation is reversed, due to the collocation of two major metropolitan areas (Phoenix and Tucson) with potential geothermal resources. R.E.S.

N80-26773*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LOW-COST SOLAR ARRAY PROJECT AND PROCEEDINGS OF THE 14TH PROJECT INTEGRATION MEETING Progress Report, Aug. - Dec. 1979
R. R. McDonald 3 Apr. 1980 479 p Meeting held 5-6 Dec. 1979
(Contracts NAS7-100; EX-76-A-29-1012; JPL Proj. 5101-142)
(NASA-CR-163263; DOE/JPL-1012/42; JPL-Pub-80-21; PR-14) Avail: NTIS HC A21/MF A01 CSCL 10A

Activities are reported on the following areas: project analysis and integration; technology development in silicon material, large area sheet silicon, and encapsulation; production process and equipment development; and engineering and operations, and the steps taken to integrate these efforts. Visual materials presented at the project Integration Meeting are included. R.E.S.

N80-26774*# Toledo Univ., Ohio.
NONLINEAR AEROELASTIC EQUATIONS OF MOTION OF TWISTED, NONUNIFORM, FLEXIBLE HORIZONTAL-AXIS WIND TURBINE BLADES Final Report
Krishna Rao V. Kaza Jul. 1980 70 p refs
(Grant NsG-3139; Contract EX-76-I-01-1028)
(NASA-CR-159502; DOE/NASA/3139-1) Avail: NTIS HC A04/MF A01 CSCL 10A

The second-degree nonlinear equations of motion for a flexible, twisted, nonuniform, horizontal axis wind turbine blade were developed using Hamilton's principle. A mathematical ordering scheme which was consistent with the assumption of a slender beam was used to discard some higher-order elastic and inertial terms in the second-degree nonlinear equations. The blade aerodynamic loading which was employed accounted for both wind shear and tower shadow and was obtained from strip theory based on a quasi-steady approximation of two-dimensional, incompressible, unsteady, airfoil theory. The resulting equations had periodic coefficients and were suitable for determining the aeroelastic stability and response of large horizontal-axis wind turbine blades. R.E.S.

N80-26775*# Boeing Engineering and Construction, Seattle, Wash.
MOD-2 WIND TURBINE SYSTEM CONCEPT AND PRELIMINARY DESIGN REPORT. VOLUME 2: DETAILED REPORT
Jul. 1979 269 p
(Contracts DEN3-2; DE-A101-79ET-20305)
(NASA-CR-159609; DOE/NASA-0002-80/2) Avail: NTIS HC A12/MF A01 CSCL 10A

The configuration development of the MOD-2 wind turbine system (WTS) is documented. The MOD-2 WTS project is a continuation of DOE programs to develop and achieve early commercialization of wind energy. The MOD-2 is design optimized for commercial production rates which, in multiunit installations, will be integrated into a utility power grid and achieve a cost of electricity at less than four cents per kilowatt hour. J.M.S.

N80-26776*# General Electric Co., Philadelphia, Pa.
DESIGN, FABRICATION, TEST, AND QUALIFICATION AND PRICE ANALYSIS OF THIRD GENERATION DESIGN SOLAR CELL MODULES
N. F. Shepard 31 Mar. 1980 113 p
(Contract JPL-955401)
(NASA-CR-163028; DOE/JPL-955401-80/1; JPL-9950-353) Avail: NTIS HC A06/MF A01 CSCL 10A

The Block 4 shingle type module makes it possible to apply a photovoltaic array to the sloping roof of a residential building by simply nailing the overlapping hexagon shaped shingles to the plywood roof sheathing. This third-generation shingle module design consists of nineteen series connected 100 mm diameter solar cells which are arranged in a closely packed hexagon configuration to provide in excess of 75 watts/sq m of exposed module area under standard operating conditions. The solar cells are individually bonded to the embossed underside of a 4.4 mm thick thermally tempered piece of glass. An experimental silicone pottant was used as the transparent bonding adhesive between the cells and glass. The semi-flexible portion of each shingle module is a composite laminate construction consisting of an outer layer of FLEXSEAL bonded to an inner core of closed cell polyethylene foam. Silaprene is used as the substrate laminating adhesive. The module design has satisfactorily survived qualification testing program which includes 50 thermal cycles between -40 and +90 C, a seven day temperature-humidity exposure test, and a wind resistance test. E.J.R.

N80-26777*# Sanders Associates, Inc., Nashua, N. H. Energy Systems Center.
DEVELOPMENT OF AN AIR BRAYTON SOLAR RECEIVER [1980] 149 p
(Contract JPL-955120)
(NASA-CR-163027; JPL-9950-351) Avail: NTIS HC A07/MF A01 CSCL 10A

Various receiver configurations and operating conditions were examined. The interface requirements between the receiver/ concentrator/power module were addressed. Production cost estimates were obtained to determine the cost of the receiver during the 1980 timeframe. A conceptual design of an air Brayton solar receiver is presented based on the results. The following

design goals were established: (1)peak thermal input power - 85 KWt; (2)receiver outlet air temperature - 1500 F; (3)receiver inlet air temperature - 1050 F; (4)design mass flow rate - 0.533 lb/sec; and (5)design receiver inlet pressure - 36.75 psia. J.M.S.

N80-26778*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR ELCAM TEMPE ARIZONA STATE UNIVERSITY, TEMPE, ARIZONA Progress Report, Jun. 1979 - Jan. 1980
May 1980 71 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161466) Avail: NTIS HC A04/MF A01 CSCL 10A

The solar system, Elcam-Tempe, was designed by Elcam Incorporated, Santa Barbara, California, to supply commercial domestic hot water heating systems to the Agriculture Department residence at Arizona State University. The building is a single story residence located at the agriculture experiment farm of the Arizona State University. The energy system's four modes of operation are described. Electrical energy savings at the site was a net of 5.54 million Btu after the 0.17 million Btu of operating energy required to operate collector loop circulating pump were subtracted. The energy savings due to solar was less than the system's potential. On an average, twice as much hot water could have been used with signifient solar energy contribution. The system corrosion and deposits caused by using dissimilar metals in the collector loop was the only problem noted with the Elcam-Tempe system. R.E.S.

N80-26779*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
PARAMETRIC STUDY OF PROSPECTIVE EARLY COMERCIAL MHD POWER PLANTS (PSPEC). GENERAL ELECTRIC COMPANY, TASK 1: PARAMETRIC ANALYSIS Final Report
C. H. Marston, F. N. Alyea, D. J. Bender, L. K. Davis, T. C. Dellinger, J. G. Hnat, E. H. Komito, C. A. Peterson, D. A. Rogers, A. J. Roman et al Feb. 1980 358 p refs Prepared in cooperation with Foster Wheeler Corp., Livingston, N.J., Hooker Chemical Co., Niagara Falls, N.Y. and Bechtel National, Inc., San Francisco
(Contract DEN3-52; EF-77-A01-2674)
(NASA-CR-159634; DOE/NASA/0052-79/1) Avail: NTIS HC A16/MF A01 CSCL 10B

The performance and cost of moderate technology coal-fired open cycle MHD/steam power plant designs which can be expected to require a shorter development time and have a lower development cost than previously considered mature OCMHD/steam plants were determined. Three base cases were considered: an indirectly-fired high temperature air heater (HTAH) subsystem delivering air at 2700 F, fired by a state of the art atmospheric pressure gasifier, and the HTAH subsystem was deleted and oxygen enrichment was used to obtain requisite MHD combustion temperature. Coal pile to bus bar efficiencies in ease case 1 ranged from 41.4% to 42.9%, and cost of electricity (COE) was highest of the three base cases. For base case 2 the efficiency range was 42.0% to 45.6%, and COE was lowest. For base case 3 the efficiency range was 42.9% to 44.4%, and COE was intermediate. The best parametric cases in bases cases 2 and 3 are recommended for conceptual design. Eventual choice between these approaches is dependent on further evaluation of the tradeoffs among HTAH development risk, O2 plant integration, and further refinements of comparative costs. J.M.S.

N80-26780*# MB Associates, San Ramon, Calif.
PROCESS DEVELOPMENT FOR AUTOMATED SOLAR CELL AND MODULE PRODUCTION. TASK 4: AUTOMATED ARRAY ASSEMBLY Final Report
30 Jun. 1980 204 p
(Contract JPL-954882)
(NASA-CR-163032; DOE/JPL-954882-80/21; JPL-9950-364) Avail: NTIS HC A10/MF A01 CSCL 10A

A process sequence which can be used in conjunction with automated equipment for the mass production of solar cell modules for terrestrial use was developed. The process sequence was then critically analyzed from a technical and economic standpoint to determine the technological readiness of certain process steps for implementation. The steps receiving analysis were: back contact metallization, automated cell array layup/interconnect, and module edge sealing. For automated layup/interconnect, both hard automation and programmable automation (using an industrial robot) were studied. The programmable automation system was then selected for actual hardware development. R.E.S.

N80-26781*# Bechtel National, Inc., San Francisco, Calif.
STUDY OF CURVED GLASS PHOTOVOLTAIC MODULE AND MODULE ELECTRICAL ISOLATION DESIGN REQUIREMENTS Final Report
Jun. 1980 182 p refs
(Contract JPL-954698)
(NASA-CR-163033; DOE/JPL-954698-80/2; JPL-9950-385) Avail: NTIS HC A09/MF A01 CSCL 10A

The design of a 1.2 by 2.4 m curved glass superstrate and support clip assembly is presented, along with the results of finite element computer analysis and a glass industry survey conducted to assess the technical and economic feasibility of the concept. Installed costs for four curved glass module array configurations are estimated and compared with cost previously reported for comparable flat glass module configurations. Electrical properties of candidate module encapsulation systems are evaluated along with present industry practice for the design and testing of electrical insulation systems. Electric design requirements for module encapsulation systems are also discussed. R.E.S.

N80-26782*# Spectrolab, Inc., Sylmar, Calif.
HIGH RESOLUTION, LOW COST SOLAR CELL CONTACT DEVELOPMENT Final Report
N. Mardesich Dec. 1979 50 p
(Contracts NAS7-100; JPL-955298)
(NASA-CR-163289; DOE/JPL-955298-80/2; JPL-9950-368) Avail: NTIS HC A03/MF A01 CSCL 10A

The experimental work demonstrating the feasibility of the MIDFILM process as a low cost means of applying solar cell collector metallization as reported. Cell efficiencies of above 14% (AMI, 28 C) were achieved with fritted silver metallization. Environmental tests suggest that the metallization is slightly humidity sensitive and degradation is observed on cells with high series resistance. The major yield loss in the fabrication of cells was due to discontinuous grid lines, resulting in high series resitance. Standard lead-tin solder plated interconnections do not appear compatible with the MIDFILM contact. Copper, nickel and molybdenum base powder were investigated as low cost metallization systems. The copper based powder degraded the cell response. The nickel and molybdenum base powders oxidized when sintered in the oxidizing atmosphere necessary to ash the photoresin. Author

N80-26783*# Syncal Corp., Sunnyvale, Calif.
DEVELOPMENT OF ADVANCED THERMOELECTRIC MATERIALS, PHASE A
30 May 1980 42 p
(Contract JPL-954349)
(NASA-CR-163041; JPL-9950-370) Avail: NTIS HC A03/MF A01 CSCL 10A

Work performed on the chemical system characterized by chrome sulfide, chrome selenide, lanthanum selenide, and lanthanum sulfide is described. Most materials within the chemical systems possess the requisites for attractive thermoelectric materials. The preparation of the alloys is discussed. Graphs show the Seebeck coefficient, electrical resistivity, and thermal conductivity of various materials within the chemical systems. The results of selected doping are included. A.R.H.

N80-26784*# Aerospace Corp., El Segundo, Calif.
CENTRAL STATION APPLICATIONS PLANNING ACTIVITIES AND SUPPORTING STUDIES Final Report
S. L. Leonard and B. Siegel Apr. 1980 117 p refs
(Contract JPL-955434)
(NASA-CR-163042; JPL-9950-372; ATR-80(7820-04)-2) Avail: NTIS HC A06/MF A01 CSCL 10B

The application of photovoltaic technology in central station (utility) power generation plants is considered. A program of

data collection and analysis designed to provide additional information about the subset of the utility market that was identified as the initial target for photovoltaic penetration, the oil-dependent utilities (especially municipals) of the U.S. Sunbelt, is described along with a series of interviews designed to ascertain utility industry opinions about the National Photovoltaic Program as it relates to central station applications. J.M.S.

N80-26785*# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
MICROWAVE BEAMED POWER TECHNOLOGY IMPROVEMENT Final Report
W. C. Brown 15 May 1980 48 p
(Contracts NAS7-100)
(NASA-CR-163043; JPL-9950-373; PT-5613) Avail: NTIS HC A03/MF A01

The magnetron directional amplifier was tested for (1) phase shift and power output as a function of gain, anode current, and anode voltage, (2) background noise and harmonics in the output, (3) long life potential of the magnetron cathode, and (4) high operational efficiency. Examples of results were an adequate range of current and voltage over which 20 dB of amplification could be obtained, spectral noise density 155 dB below the carrier, 81.7% overall efficiency, and potential cathode life of 50 years in a design for solar power satellite use. A fabrication method was used to fabricate a 64 slot, 30 in square slotted waveguide array module from 0.020 in thick aluminum sheet. The test results on the array are discussed. J.M.S.

N80-26786# Committee on Science and Technology (U. S. House).
OVERSIGHT: INDUSTRIAL ENERGY CONSERVATION, VOLUME 10
Washington 1979 327 p refs Hearing before Subcomm. on Energy Develop. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 49, 11 Sep. 1979
(GPO-53-020) Avail: SOD

Testimony delivered and statements received in support of industrial energy conservation through cogeneration are presented. The Federal government's role and policy on industrial energy conservation is discussed. R.E.S.

N80-26787# Central Technical Inst. TNO, Apeldoorn (Netherlands). Afdeling Warmte- en Koudetechniek.
LECTURES ON HEAT TECHNOLOGY IN THE NETHERLANDS [VOORDRACHTEN VAN DE 39 STE VAKANTIE-LEERANG VOOR WARMTETECHNIEK, GEHOUDEN OP 23 EN 24 AUGUSTUS, 1977]
1977 69 p refs In DUTCH; ENGLISH summary Lectures of the 39th Summer Course on Heat Technol., 23-24 Aug. 1977 Prepared in cooperation with Koninkelijke Inst. van Ingenieurs, The Hague, Netherlands Technische Vereniging voor Verwarming en Luchtbehandeling
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

Lectures were given dealing with heat-activated heat pumps, heat pumps in home heating, air/air heat pumps, energy consumption and possible savings in office buildings, solar water heating, and design of a home solar heating unit through use of a mathematical model. For individual titles, see N80-26788 through N80-26793.

N80-26788# Central Technical Inst. TNO, Apeldoorn (Netherlands). Afdeling Warmte- en Koudetechniek.
HEAT-ACTIVITED HEAT PUMPS
H. vanderRee *In its* Lectures on Heat Technol. in the Netherlands 1977 p 5-18 refs In DUTCH; ENGLISH summary (For primary document see N80-26787 17-44)
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

The thermodynamics of energy conversion through heat-activated heat pumps are described. Some practical systems, heat performances and recent developments in this field are discussed. A distinction is made between processes which depend on the transfer of mechanical energy and systems that are characterized by the fact that moving parts are absent or nearly absent (absorption, resorption, ejector heat pumps) Author (ESA)

N80-26789# Central Technical Inst. TNO, Apeldoorn (Netherlands). Afdeling Warmte- en Koudetechniek.
SURVEY OF FOREIGN RESEARCH IN THE FIELD OF HEAT PUMPS FOR THE HEATING OF DWELLINGS [OVERZICHT VAN BUITENLANDSE ONDERZOEKEN AAN WARMTEPOMPEN VOOR WONINGVERWARMING]
W. E. J. deBeyer *In its* Lectures on Heat Technol. in the Netherlands 1977 p 19-29 refs In DUTCH (For primary document see N80-26787 17-44)
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

The literature of the U.S.A., Germany, France, Sweden, Denmark, Switzerland, and England shows that parallel and often overlapping research is being done. Topics covered are: heat recovery; cycle systems; waste heat recovery; cryogenics; unitary heat pumps; thermal flow; and mono and bivalent heat pumps. Economic aspects are also discussed. Author (ESA)

N80-26790# Central Technical Inst. TNO, Apeldoorn (Netherlands). Afdeling Warmte- en Koudetechniek.
CASE STUDY OF AN AIR TO AIR HEAT PUMP [PRAKTIJKONDERZOEK AAN EEN LUCHT/LUCHT WARMTEPOMP]
J. F. vanderHorst *In its* Lectures on Heat Technol. in the Netherlands 1977 p 31-38 refs In DUTCH (For primary document see N80-26787 17-44)
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

A commercially available, electrically operated air-to-air heat pump was installed and tested in a single family dwelling in the Netherlands. The unit functioned reliably, but no energy savings was possible. Air transport via the evaporator and condenser was insufficient, and did not permit the manufacturers specifications to be met. Author (ESA)

N80-26791# Technische Physische Dienst TNO-TH, Delft (Netherlands).
EXAMINATION OF ENERGY CONSUMPTION AND THE POSSIBILITIES OF ENERGY SAVINGS IN OFFICE BUILDINGS [ONDERZOEK OUER HET ENERGIEVERBRUIK EN OVER DE MOGELIJKHEDEN TOT ENERGIEBESPARING IN UTILITEITSGEBOUWEN]
P. Euser, M. Hugenholtz (Adviesbureau), and P. W. Deerns (Bureau Deerns) *In* Central Tech. Inst. Lectures on Heat Technol. in the Netherlands 1977 p 39-50 refs In DUTCH (For primary document see N80-26787 17-44)
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands, FL 30

Projected energy savings were computed for various building shapes and orientations with respect to the Sun. The effects of making better use of daylight, of using lower light levels, of directing light at work areas, and of continuously regulating the levels of artificial lighting, are shown. Author (ESA)

N80-26792# Technische Physische Dienst TNO-TH, Delft (Netherlands).
THE POTENTIAL FOR HEAT PRODUCTION WITH SOLAR WATER HEATERS IN THE NETHERLANDS CLIMATE [DE POTENTIELE WARMTEPRODUKTIE MET EEN ZONNEBOILER IN HET NEDERLANDSE KLIMAAT]
C. denOuden *In* Central Tech. Inst. Lectures on Heat Technol. in the Netherlands 1977 p 51-57 refs In DUTCH (For primary document see N80-26787 17-44)
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

The technical aspects of the solar water heater are described, and various designs presented. The energy production during an average year in the Netherlands using different configurations is computed. An economic analysis based upon a system with a 4 sq m collector is given. Author (ESA)

N80-26793# Technische Physische Dienst TNO-TH, Delft (Netherlands).
THE DESIGN OF A SOLAR HOME HEATING INSTALLATION, USING A MATHEMATICAL MODEL [HET ONTWERPEN VAN EEN ZONNEVERWARMINGS- INSTALLATIE VOOR EEN WONING MET BEHULP VAN EEN REKENMODEL]
E. vanGalen, A. J. T. M. Wijsman, and C. denOuden *In* Central Tech. Inst. Lectures on Heat Technol. in the Netherlands 1977

p 59-69 *ref* In DUTCH Sponsored by Netherlands Min. van Econ. Zaken (For primary document see N80-26787 17-44)
Avail: NTIS HC A04/MF A01; Central Tech. Inst., Apeldoorn, Netherlands FL 30

The model is capable of simulating a complete system, including the collector and the distribution system in the home. Efficiencies of various types of collectors are accommodated. Results of some runs are presented. Comparative cost data for solar and conventional systems are given. Solar systems are shown to be economical for home heating only in well-insulated buildings. Author (ESA)

N80-26794# American Univ., Washington, D. C.
DEFINITION OF CHEMICAL AND ELECTROCHEMICAL PROPERTIES OF A FUEL CELL ELECTROLYTE Interim Technical Report, 24 Jul. 1978 - 24 Dec. 1979
Jalil Ahmad and R. T. Foley Jan. 1980 70 p refs
(Contract DAAK79-77-C-0080; DA Proj. 1K1-61102-AH-51)
(AD-A083608) Avail: NTIS HC A04/MF A01 CSCL 07/4

The present research is oriented toward the task of developing an improved electrolyte for the direct hydrocarbon-air fuel cell. The electrochemical behavior of methanesulfonic acid, ethanesulfonic acid, and sulfoacetic acid as fuel cell electrolytes was studied in a half cell at various temperatures. The rate of electro-oxidation of hydrogen at 115 degrees was very high in methanesulfonic acid and sulfoacetic acids. The rate of the electro-oxidation of propane in methanesulfonic acid at 80 C and 115 C was low. Further, there is evidence for adsorption of these acids on the platinum electrode. Sulfoacetic acid with H2 has supported about two times higher current density than trifluoromethanesulfonic acid monohydrate, but, attempts to purify the compound were unsuccessful. It was concluded that anhydrous sulfonic acids are not good electrolytes; water solutions are required. Sulfonic acids containing unprotected C-H bonds are adsorbed on platinum and probably decompose during electrolysis. A completely substituted sulfonic acid would be the preferred electrolyte. GRA

N80-26795# Tennessee Univ., Knoxville. Dept. of Chemistry.
EVALUATION OF LOW MELTING HALIDE SYSTEMS FOR BATTERY APPLICATIONS Interim Report, 1 Sep. 1978 - 31 Aug. 1979
Gleb Mamantov AFAPL Wright-Patterson AFB, Ohio Nov. 1979 47 p refs
(Contract F33615-78-C-2075; AF Proj. 3145)
(AD-A083434; AFAPL-TR-79-2124) Avail: NTIS HC A03/MF A01 CSCL 10/3

This three year program involves evaluation of selected low temperature molten salt solvent systems containing inorganic and/or organic chlorides and bromides for battery applications. The research involves determination of the liquidus temperatures, the specific electrical conductivity, and the electrochemical span of selected halide systems. Characterization of the solvent species by Raman spectroscopy, vapor pressure measurements, and the electrochemical study of a few cathode and anode systems will be undertaken for the most promising solvent system. GRA

N80-26796# Rocketdyne, Canoga Park, Calif.
HIGH ENERGY STORAGE FLYWHEEL TEST PROGRAM Final Report
D. R. Hodson 28 Jan. 1980 148 p refs
(Contract DAAG53-75-C-0278)
(AD-A083302; RI/RD78-207-1) Avail: NTIS HC A07/MF A01 CSCL 10/3

The RS-31 Flywheel System is an energy storage device which is accelerated by an AVCO LYCOMING T55-L-7C 2930 SHP drive engine to 14,506 RPM. The two contra-rotating double disk rotors of the flywheel module have an inertia of 320,176 sq. in.-lbs storing 30 KW-HRS of energy at design speed. This was a Research Development test activity designed to explore and verify design predictions of system performance. GRA

N80-26797# Research Triangle Inst., Research Triangle Park, N. C.
DEVELOPMENT OF HIGH EFFICIENCY STACKED MULTIPLE BANDGAP SOLAR CELLS Final Report, 1 Aug. 1978 - 30 Sep. 1979
S. M. Bedair, J. R. Hauser, M. F. Lamorte, S. Phatak, M. L. Timmons, J. E. Andrews, and M. Simmons Wright-Patterson AFB AFAPL Oct. 1979 102 p refs
(Contract F33615-78-C-2077)
(AD-A083092; RTI-41U-1678; AFAPL-TR-79-2116) Avail: NTIS HC A06/MF A01 CSCL 10/2

The objective of this research was to develop the technology required to fabricate two-junction, cascade solar cell assemblies having conversion efficiencies exceeding 25 percent when operating at 25 deg C under 1 sun, AM 0 conditions. The experimental effort has focused on several different III-V ternary and quaternary materials that show promise for use in fabricating a cascade cell. These include GaAlAs, GaInAs, GaInP, GaAsSb, and GaAlAsSb. The work also includes theoretical calculations of cascade solar cell performance over a wide range of operating temperatures. GRA

N80-26798# Army Construction Engineering Research Lab., Champaign, Ill.
DENSIFIED BIOMASS AS AN ALTERNATIVE ARMY HEATING AND POWER PLANT FUEL HEATING Final Report
S. A. Hathaway, J. S. Lin, D. Mahon, T. Magrino, and K. Duster Mar. 1980 88 p refs
(AD-A083317; CERL-TR-E-158) Avail: NTIS HC A05/MF A01 CSCL 10/1

This investigation evaluated the technical and economic potential of using of densified biomass (principally wood pellets) as a coal substitute in Army heating and power plants. The report reviews Department of Defense DOD experience with and tests of wood pellets production of wood pellets (excluding silvicultural aspects) handling, storing, and feeding; combustion; major environmental considerations; and economics of use. GRA

N80-26799# Naval Research Lab., Washington, D. C. Plasma Technology Branch.
CURRENT INTERRUPTION IN INDUCTIVE STORAGE SYSTEMS WITH INERTIAL CURRENT SOURCE Interim Report
I. M. Vitkovitsky, D. Conte, R. D. Ford, and W. H. Lupton 5 Mar. 1980 23 p refs
(RF0110941)
(AD-A083914; NRL-MR-4168) Avail: NTIS HC A02/MF A01 CSCL 10/2

Utilization of inertial current source inductive storage with high power output requires a switch with short opening time. This switch must operate as a circuit breaker, i.e., be capable to carry the current for a time period characteristic of inertial systems, such as homopolar generators. For reasonable efficiency, its opening time must be fast to minimize the energy dissipated in downstream fuse stages required for any additional pulse compression. A switch that satisfies these criteria, as well as other requirements such as that for high voltage operation associated with high power output, is an explosively driven switch consisting of large number of gaps arranged in series. The performance of this switch in limiting and/or interrupting currents produced by large generators has been studied. Single switch modules were designed and tested for limiting the commutating current output of 1 MW, 60 Hz, generator and 500 KJ capacitor banks. Current limiting and commutation were evaluated, using these sources, for currents ranging up to 0.4 MA. The explosive opening of the switch was found to provide an effective first stage for further pulse compression. It opens in tens of microseconds, commutates current at high efficiency ($> = 905$) recovers very rapidly over a wide range of operating conditions. GRA

N80-26800# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
REQUIREMENT DEFINITION AND PRELIMINARY DESIGN OF A PHOTOVOLTAIC CENTRAL POWER STATION EXPERIMENTAL TEST FACILITY. VOLUME 2: SOLMET SITE INSOLATION AND WEATHER DATA
G. OBrien Dec. 1979 481 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7022-Vol-2) Avail: NTIS HC A21/MF A01

The results of a study of the requirements and preliminary design for a photovoltaic central power station experimental

test facility presented. The facility's initial capacity of 2 MW with growth to 10 MW is intended to assess photovoltaic array fields operating as generation sources in utility systems. Requirements, a preliminary design, costs and schedule were established for the facility construction. Utility participation were reviewed with selected utilities, and both a site selection methodology and a summary set of combined continental US insolation and meteorological data was prepared. A set insolation and weather data for 26 SOLMET sites are included. DOE

N80-26801# Boeing Engineering and Construction, Seattle, Wash.
SOLAR CENTRAL RECEIVER PROTOTYPE HELIOSTAT. VOLUME 3: COST ESTIMATES
1 Jun. 1978 149 p
(Contract EG-77-C-03-1604)
(SAN-1604-3) Avail: NTIS HC A07/MF A01

The Boeing heliostat design was produced and installed for a capital cost of $42 per square meter at high commercial plant quantities and rates. This is 14% less than the DOE cost target. Even at a low commercial plant production rate of 25,000 heliostats per year the captial cost of $48 per square meter 2% less than the cost goal established by the DOE. Projected captial cost and 30 year maintenance costs for three scenarios of production and installation are presented: (1) commercial rate production of 25,000, 25,000 and 1,000,000 heliostats per year; (2) a one-time only production of 25,000 heliostats per year with each plant (25,000 heliostats) installed at widely dispersed sites throughout the southwestern United States. These three scenarios for solar plant locations and the manufacturing/installation processes are fully described, and detailed cost breakdowns for the three scenarios are provided. DOE

N80-26802# Jalor Associates, San Francisco, Calif.
INDUSTRIAL COMPRESSED AIR APPLICATIONS FOR SOLAR ENERGY CONVERSION/STORAGE DEVICES Final Report
Laurence B. McEwen, Jr. and John W. Swain, Jr. Jan. 1980 162 p refs Prepared for Sandia Labs., Albuquerque
(Contract EY-76-C-04-0789)
(SAND-79-7077) Avail: NTIS HC A08/MF A01

A survey was made of industrial compressed air installations in this country with emphasis on air usage patterns, types of equipment, and energy/power requirements. This was followed by an investigation into the technical feasibility of utilizing solar energy conversion systems to power representative industrial compressed air systems. The final task was to evaluate the economic merits of three diverse scenarios of conceptual industrial compressed-air installation. None of the three were found to be economically attractive until approximately 10 years after completion of construction with one of the primary reasons being the high capitalized cost of the associated solar powered air compression systems. A proper combination of technological improvements in solar energy conversion systems, reduced capital costs, accelerated rises in utility rates, and continued uncertainty in fossil fuel availability is regarded as necessary before further pursuit of this concept is warranted. DOE

N80-26803# AiResearch Mfg. Co., Torrance, Calif.
HIGH-ENERGY-DENSITY COMPOSITE FLYWHEEL
David L. Satchwell and Dennis A. Towgood Feb. 1980 113 p refs
(Contracts EY-76-C-04-0789; ATI29-1)-789)
(SAND-79-7019) Avail: NTIS HC A06/MF A01

A flywheel was designed and fabricated to demonstrate a high energy density of 80 w-h/kg in the rotor. The rotor design consists of a multiring, subcircular rim made of S-glass/epoxy composite and Kevlar/epoxy composite materials and mounted on a spoked hub made of graphite/epoxy composite materials. DOE

N80-26804# Battelle Pacific Northwest Labs., Richland, Wash.
POTENTIAL PETROPHYSICAL AND CHEMICAL PROPERTY ALTERATIONS IN A COMPRESSED AIR ENERGY STORAGE POROUS ROCK RESERVOIR
J. A. Stottlemyre, R. L. Erikson, and R. P. Smith Oct. 1979 88 p refs
(Contract EY-76-C-06-1830)
(PNL-2974) Avail: NTIS HC A05/MF A01

Successful commercialization of compressed air energy storage (CAES) systems depends on long term stability of the underground reservoirs subjected to somewhat unique operating conditions. A discussion on relative importance to CAES of several potential porous media damage mechanisms is presented. In this context, damage is defined as a reduction in intrinsic permeability (measure of air transport capability), a decrease in effective porosity (measure of storage capability), or an increase on elastic and/or inelastic deformation of the porous material. The potential damage mechanisms presented include: (1) disaggregation, (2) particulate plugging, (3) boundary layer viscosity anomalies, (4) inelastic microstructural consolidation, (5) clay swelling and dispersion (6) hydrothermal mineral alteration, (7) oxidation reactions, and (8) well casing corrosion. DOE

N80-26805# Brobeck (William M.) and Associates, Berkeley, Calif.
CONCEPTUAL DESIGN OF A FLYWHEEL ENERGY STORAGE SYSTEM Final Report
Nov. 1979 103 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7088; REPT-4500-92-9-R1) Avail: NTIS HC A06/MF A01

A conceptual design of a flywheel energy storage system suitable for on-site interfacing with residential photovoltaic (PV) energy sources was developed. The basic design concept and the general approach to the conceptual design of the energy storage system are described. Cost of the system was determined for production models to be produced in annual quantities up to one hundred thousand for both 10-kWh and 50-kWh capacities, and also for a 10 kWh one-of-a-kind demonstration model. DOE

N80-26806# California Univ., Livermore. Lawrence Livermore Lab.
SITE AND BUILDING ENERGY CONSERVATION STUDY. LOW-CONDUCTIVITY COOLING WATER SYSTEM
Oct. 1979 13 p
(Contract W-7405-eng-48)
(UCRL-15196; Rept-79-83-R) Avail: NTIS HC A02/MF A01

Low conductivity cooling water is a high quality deionized cooling water which is recirculated. The system supplies water for experimental cooling equipment, shop equipment, and as a condenser cooling medium for refrigeration and air conditioning systems. Low conductivity water is purified, cooled, and recirculated at three buildings. The systems description, operation, and energy conservation opportunities are indentified. DOE

N80-26807# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
DISCHARGE CHARACTERISTICS OF LITHIUM-BORON ALLOY ANODE IN MOLTEN SALT THERMAL CELLS
R. Szwarc and R. D. Walton 31 Mar. 1980 26 p refs
(Contract EY-76-C-04-0656)
(GEPP-TIS-451) Avail: NTIS HC A03/MF A01

Thermal cells comprised of Li-B anodes, LiCl-KCl eutectic electrolyte, and one of three depolarizers, CaCrO4, Li2CrO4, or FeS2, were investigated. These cells require a separator layer to obviate direct redox reactions between the anode and the cathode. The separator developed for these cells is an electrolyte layer immobilized with MgO is inert with respect to the anode as well as other cell components. Of the three systems investigated, the LiB/FeS2 combination is most promising for primary thermal batteries, particularly for long-life power designs. . DOE

N80-26808# Kaiser Engineers, Oakland, Calif.
SITE AND BUILDING ENERGY-CONSERVATION STUDY: SURVEY OF BUILDING 3, EXPERIMENTAL PHYSICS
Oct. 1979 106 p Prepared in cooperation with Consultants Computation Bureau, Oakland, Calif. Prepared for Calif. Univ., Livermore, Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15195; REPT-79-65-RE) Avail: NTIS HC A06/MF A01

An energy conservation study of Building 3, Experimental Physics was conducted. The survey was based on a detailed review of the as-built drawings, an onsite inspection of the 100,000-sq ft building, and discussions with the building manager

and various operating personnel. Data were collected regarding the number of people occupying the building, operating schedules, and the energy loads imposed by installed and temporary equipment. The heating, ventilating and air conditioning systems were investigated. A base-year energy-consumption run was made, together with simulations of the building's performance assuming installation of each of nine energy conservation opportunities (ECO's) and combinations identified. The energy savings resulting from the implementation of the ECO's are summarized. DOE

N80-26809# Spire Corp., Bedford, Mass.
AMORPHOUS SILICON SOLAR CELLS BY HYDROGEN IMPLANTATION Quarterly Report, 1 Apr. - 30 Jun. 1979
A. R. Kirkpatrick and A. A. Melas Aug. 1979 19 p
(Contract DE-AC03-79ET-23042)
(SAN-3042-2; QR-10064-02) Avail: NTIS HC A02/MF A01

The use of cell devices to provide information regarding application of ion implantation to amorphous silicon cells was investigated. Developmental activities described include the preparation of implantation capabilities and procedures, preparation of processing routines for a test cell device and preliminary evaluation of the effects of hydrogen implantation upon operation of devices. DOE

N80-26810# TRW Systems Group, McLean, Va.
COMPARISON OF COSTS FOR AUTOMOBILE ENERGY CONSERVATION VS SYNTHETIC FUEL PRODUCTION
Richard Gorman and Kenneth L. Heitner 1980 32 p refs
Presented at the 5th Symp. on Automotive Propulsion Systems, Dearborn, Mich., 14 Apr. 1980
(Contract AC01-79PE-70151)
(CONF-800419-1) Avail: NTIS HC A03/MF A01

The analysis suggests that there are a large number of potential technical options for reducing energy consumption in automobiles. Furthermore, the cost to the user of purchasing these conservation options is less than the discounted cost of purchasing the additional fuel required if the conservation option is not chosen. There is a significant cost savings even if fuel costs remain at current levels. These savings would increase if fuel prices continue to rise or if more costly than synthetic fuels, at least for another 15 to 20 years. Cost effective conservation could enable new vehicles to reach 40 to 50 mpg corporate average fuel economy by the year 2000. It is clear that the potential for making these changes exists, but better data are needed to evaluate many of these options and to ensure the development and implementation of those that are desirable. DOE

N80-26811# Boeing Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR ZIEN MECHANICAL CONTRACTORS-I SINGLE FAMILY RESIDENCE, MILWAUKEE, WISCONSIN
D. Beers 5 Feb. 1980 48 p
(Contract EX-76-A-29-1020)
(SOLAR/1057-79/50-Pt-1) Avail: NTIS HC A03/MF A01

The Zien Mechanical site is a single family residence located in Milwaukee, Wisconsin. The home has two separate solar energy systems: an air system for space heating and cooling; a liquid system to preheat the potable hot water. The space heating and cooling system design and operation modes are described. The space heating system is designed to apply approximately 44 percent of the space heating requirements for the 1388 square foot residence. Engineering drawings are provided and the performance evaluation instrumentation is described. R.E.S.

N80-26812# Boeing Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR ALPHA CONSTRUCTION COMPANY'S SINGLE FAMILY RESIDENCE, CANTON, OHIO
D. Beers 21 Sep. 1979 53 p
(Contract EX-76-A-29-1020)
(SOLAR/1034-79/50) Avail: NTIS HC A04/MF A01

The solar energy system for a new single family detached residence in Canton, Ohio, preheats domestic hot water and supplements heating energy for 2460 square feet of occupied space. The solar energy system is designed to provide approximately 50 percent of the space heating and 70 percent of the hot water energy requirements for the home. The system design and operation modes are described. Engineering drawings are provided and the performance evaluation instrumentation is described. R.E.S.

N80-26813# Boeing Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR STEWART-TEELE-MITCHELL SINGLE FAMILY RESIDENCE, MALTA, N.Y.
D. Beers 5 Dec. 1979 51 p
(Contract EX-76-A-29-1020)
(SOLAR/1018-79/50) Avail: NTIS HC A04/MF A01

The Stewart-Teele-Mitchell solar energy system is installed in a 1900 square-foot, single family dwelling located in Malta, New York. The system is designed to provide solar energy for space heating, and domestic hot water heating. The system design and operation modes are described. Engineering drawings are provided and the performance evaluation instrumentation is described. R.E.S.

N80-26814# Boeing Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR WASHINGTON NATURAL GAS COMPANY'S SINGLE FAMILY RESIDENCE, KIRKLAND, WASHINGTON
D. Beers 12 Sep. 1979 48 p
(Contract EX-76-A-29-1020)
(SOLAR/1001-79/50) Avail: NTIS HC A03/MF A01

The solar energy system for a new single family detached residence in Kirkland, Washington, preheats domestic hot water and heats 2607 square feet of occupied space. The system design and operation modes are described. Engineering drawings are provided and the performance evaluation instrumentation is described. R.E.S.

N80-26815# Boeing Co., Seattle, Wash.
SOLAR PROJECT DESCRIPTION FOR ZIEN MECHANICAL 2 SINGLE FAMILY RESIDENCE, MILWAUKEE, WISONSIN
5 Feb. 1980 44 p
(Contracts EX-76-A-29-1020; H-2372)
(SOLAR/1057-79/50-Pt-2) Avail: NTIS HC A03/MF A01

Zien Mechanical Contractors No. 2 is a single-family residence in Milwaukee, Wisonsin. The home has approximately 1304 square feet of conditioned space. The solar energy system consists of two independently controlled systems: one system is used for domestic hot water preheating, the other is used for space heating and cooling. The domestic hot water system design and operation modes are described. Engineering drawings are provided and the performance evaluation instrumentation is described. R.E.S.

N80-26816# Burt, Hill, Kosar, Rittleman, and Associates, Butler, Pa.
SOLAR-ASSISTED LOW ENERGY DWELLINGS Final Report
Torben V. Esbensen Feb. 1980 113 p refs
(Contract EY-76-S-05-4908)
(DOE/CS-0145; CCMS-93) Avail: NTIS HC A06/MF A01

The Zero Energy House Group was formed as a subproject of the CCMS Solar Energy Pilot Study in 1974 by seven participating countries experimenting with solar-assisted low-energy dwellings for temperate and northern European climatic conditions. A Zero Energy House is one in which solar energy is used to meet the reduced energy needs of buildings incorporating various thermal energy conservation features. This is the final report of the Zero Energy House Group. It includes brief descriptions of 13 major low-energy dwellings in the participating CCMS countries. An overall assessment of the state-of-the-art in solar-assisted low-energy dwellings is given. DOE

N80-26817# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PROJECTS FROM FEDERAL REGION 9: DEPARTMENT OF ENERGY APPROPRIATE ENERGY TECHNOLOGY PROGRAM, PART 2
C. W. Case, H. R. Clark, J. Kay, F. B. Lucarelli, and S. Rizer Jan. 1980 50 p refs
(Contract W-7405-eng-48)
(LBL-10098) Avail: NTIS HC A03/MF A01

Details and progress of appropriate energy technology programs in Region 9 (Arizona, California, and Hawaii) are

presented. Each on-going project is individually described and includes details on direct and indirect energy savings. Also included are information on innovative features, regional or national demonstration possibilities, and aspects of the project which can be replicated elsewhere either on a regional or national scale. R.E.S.

N80-26818# Mississippi State Univ., Mississippi State. Engineering and Industrial Research Station.
ADDITION OF INEXPENSIVE SOLAR AIR-HEATERS TO A PRE-ENGINEERED METAL BUILDING Final Report, 25 Sep. 1977 - 25 Mar. 1979
Richard E. Forbes and Ronald W. McClendon May 1979 52 p refs
(Contracts EG-77-G-04-4086; EG-77-C-29-0001)
(ALO-4086-1) Avail: NTIS HC A03/MF A01

The use of site built solar collectors for heating air in poultry houses was studied in order to design and test a functional air heater solar collector which would be inexpensive to construct and acceptable to poultry producers. The results reported are an extension of the original concept. The basic concept is to use a pre-engineered metal building for the structure and incorporate the solar air heaters as an integral part of the south facing wall of the building. The outer skin of the building is used as the absorber plate for the collectors. Construction and testing of the solar collectors and heat storage systems are discussed, and the performance characteristics of the site built solar collectors are described. DOE

N80-26819# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
DEVELOPMENT OF POLYCRYSTAL GaAs SOLAR CELLS Quarterly Technical Progress Report, 1 Aug. - 30 Oct. 1979
D. L. Miller, Marshall J. Cohen, J. S. Harris, Jr., Joseph Ballantyne (Cornell Univ., Ithaca, N.Y.), and Elias Stefanakos (N.C. A and T State Univ., Greensboro) Dec. 1979 49 p
(Contract EG-77-C-01-4042)
(DSE-4042-T2R; QTPR-3) Avail: NTIS HC A03/MF A01

Progress on the development of thin film polycrystal GaAs solar cells with 10% conversion efficiency is described. Highlights include the growth of Ge on Fe substrates and the investigation of various grain boundary passivation schemes. DOE

N80-26820# Midwest Research Inst., Golden, Colo.
SERI SOLAR ENERGY STORAGE PROGRAM
Robert J. Copeland, John D. Wright, and Charles E. Wyman Feb. 1980 12 p refs Presented at the Thermal Energy Storage Review Meeting, Tysons Corner, Va., 3 Dec. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-333-497; CONF-791232-1) Avail: NTIS HC A02/MF A01

Research on advanced technologies, system analyses, and assessments of thermal energy storage for solar applications in support of the Thermal and Chemical Energy Storage program are presented. Currently, research is in progress on direct contact latent heat storage and thermochemical energy storage and transport. Systems analyses are being performed of thermal energy storage for solar thermal applications, and surveys and assessments are being prepared of thermal energy storage in solar applications. DOE

N80-26821# Southern Methodist Univ., Dallas, Tex.
THIN FILM CADMIUM TELLURIDE SOLAR CELLS Technical Progress Report, 1 Jul. - 30 Sep. 1979
Ting L. Chu Oct. 1979 33 p refs
(Contract DE-AC04-79ET-23009)
(DOE/ET-23009/T1; TPR-1) Avail: NTIS HC A03/MF A01

Cadmium telluride films deposited on a number of substrates by the direct combination of cadmium and tellurium on the substrate surface at 550 to 740 C. At substrate temperatures below 550 C, the deposit was non-adherent. In the temperature range 580 to 740 C, the deposition rate 0.5 to 1 micrometers min. and the microstructure and crystallographic properites of deposited films, were investigated. Without intentional doping, cadmium telluride films deposited on mullite substrates have room temperature resistivities and carrier concentrations of (4-7) x 10 to the 4th power ohm-cm and (6-9) x 10 to the 12th power/cu cm, respectively. Current-voltage measurements os Schottky barriers prepared from cadmium telluride films indicate the rectifying interface in CdTe/W/graphite, CdTe/graphite, CdTe/Al/graphite structures and the presence of pinholes in the films. DOE

N80-26822# Stanford Linear Accelerator Center, Calif.
MORE ON DUAL PURPOSE SOLAR-ELECTRIC POWER PLANTS
F. F. Hall Feb. 1980 17 p refs Presented at the 2nd Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10 Dec. 1979
(Contract EY-76-C-03-0515)
(SLAC-PUB-2477; CONF-791204-33) Avail: NTIS HC A02/MF A01

Dual purpose solar-electric plants are discussed. The rationale for such plants is reviewed and plant elements are listed. Heat extraction, energy storage, and plant costs are discussed. DOE

N80-26823# Trident Engineering Associates, Inc., Annapolis, Md.
SURVEY AND EVALUATION OF CURRENT DESIGN OF EVACUATED COLLECTORS Final Technical Report
B. J. Graham 30 Sep. 1979 192 p refs
(Contract EM-78-C-04-5350)
(ALO-5350-1) Avail: NTIS HC A09/MF A01

The general development of evacuated collectors is described. A table summarizing all of the available collectors, along with their characteristics, is presented. There are four evacuated collectors which have been tested, used in demonstration sites, and developed for the market. These collectors are described in detail, and they are compared in performance and cost with a well engineered, double glazed, selectively coated, flat plate collector. A rather simple model system of about 2000 sq ft of collector area for each of the four evacuated collectors and the flat plate collector is described, along with the support structure and the piping for each. Details of the cost are presented in order to compare collector costs with component costs. All of the available efficiency curves of collectors were plotted for comparison with the effeciency curve of a good, flat plate collector. DOE

N80-26824# Argonne National Lab., Ill. Energy and Environmental Systems Div.
RELIABILITY AND MATERIALS PERFORMANCE OF SOLAR HEATING AND COOLING SYSTEMS
P. S. Chopra Jun. 1979 24 p refs
(Contract W-31-109-eng-38)
(SOLAR/0906-79/70; ANL/SDP-TM-79-8) Avail: NTIS HC A02/MF A01

The reliability field information collected to date from the solar heating and cooling systems sponsored by the US Department of Energy and the evaluation of four system-reliability problems freezing, leaks, controls, and collectors are summarized. An example of a reliability analysis for a hot water preheating system is presented using data on component failures obtained primarily from nonsolar sources. The status of material assessment activities is discussed along with the results of initial studies of the properties of heat transfer fluids and the scaling caused by the fluids. DOE

N80-26825# Delaware Univ., Newark. College of Engineering.
SHAPE OF CURRENT VOLTAGE CHARACTERISTICS OF SOLAR CELLS. THEORY OF THIN-FILM PHOTOVOLTAICS
Karl W. Boer 1979 39 p refs Prepared in cooperation with SES, Inc., Newark, Del.
(Contract DE-AC01-79ET-23103)
(DOE/ET-23103/10; TR-2) Avail: NTIS HC A03/MF A01

By proper integration of Poisson and transport equations, considering the junction boundary conditions, current-voltage characteristics of a wide variety of shapes are obtained. The shape depends critically on these boundary conditions and on material properties. In turn, deviation from the ideal characteristics can be used to determine several material properties of a photovoltaic device. It is possible to categorize deviation from the ideal diode behavior and use simple approximations to obtain defect level distribution, interface recombination velocity and critical fields for field related junction effects. This discussion

augments the previous model using a resistive network to alter characteristics and modifies the model using diodes of different A-factors in the exponent. It assists in analyzing less than perfect solar cells to obtain directions for possible improvements. DOE

N80-26826# California Univ., Berkeley. Lawrence Berkeley Lab. Energy Analysis Program.
ASSESSMENT OF SOLAR ENERGY WITHIN A COMMUNITY: SUMMARY OF THREE COMMUNITY-LEVEL STUDIES Summary Report
Ronald L. Ritschard Oct. 1979 37 p refs Sponsored by DOE
(DOE/EV-0054) Avail: NTIS HC A03/MF A01

An analysis of the potential health, environmental, and social/economic consequences of large-scale (national in scope) commercialization of solar technologies is discussed. A summary of three studies concentrating on the potential community-level impacts of such commercialization is given. The results of these studies provide enrichment of the national-level project by identifying for policymakers specific community-level issues that may arise as a result of federal policy. The three studies are: (1) community-level environmental impacts of decentralized solar technologies; (2) community impediments to implementation of solar energy; and (3) three solar urban futures: characterizations of a future community under three energy supply scenarios.DOE

N80-26827# EIC, Inc., Newton, Mass.
ELECTRODEPOSITION OF POLYCRYSTALLINE AND AMORPHOUS SILICON FOR PHOTOVOLTAIC APPLICATIONS Quarterly Technical Progress Report, 11 Sep. - 30 Nov. 1979
R. D. Rauh, T. G. Hoover, and D. L. Natwig Feb. 1980 26 p refs
(Contract DE-AC03-79ET-23046)
(DOE/ET-23046/2; QTR-2) Avail: NTIS HC A03/MF A01

Electrochemical measurements were made on SHCl3 and (CH3)3SiCl to determine if they were suitable precursors for electrodepositing silicon from organic solvents. The precursors were dissolved in solutions of propylene carbonate containing 0.1M tetrabutylammonium tetrafluoroborate (TBATFB). Cyclic voltammograms of the systems were run at 25 C and 70 C using Pt as the reference electrode and Pt, Al, or Mo wires as the working electrode. The results showed that the two peaks appearing between 0 and -1.0V could be attributed to impurities made electroactive by addition of the silicon precursor. Reduction to silicon occurred with SHCl3 between -1.0 to -2.8V; however, for (CH3)3SiCl, no reduction leading to silicon deposition was observed in this region. Several deposits of silicon were done potentiostatically on Mo, Al, and Ni discs. The thickness, surface finish and color of the amorphous deposits were dependent on the precursor concentration, temperature and material, and surface finish of the metal working electrode. DOE

N80-26828# Exxon Research and Engineering Co., Linden, N.J. Advanced Energy Systems Labs.
THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS Quarterly Report, 1 Jul. - 30 Sep. 1979
Amal K. Ghosh, Tom Feng, and H. Paul Maruska 1979 30 p refs
(Contract DE-AC03-79ET-23047)
(DOE/SF/23047-3; QR-3) Avail: NTIS HC A03/MF A01

The details of the fabrication procedures for making SnO2/nSi, ITO/n-Si, and metal insulated semiconductors solar cells are given. A low cost and highly reproducible spray deposition process for tin oxide and indium tin oxide (ITO was used to make SnO2/n-Si and ITO/n-Si, solar cells with power conversion efficiencies of 10 and 13% for polycrystalline and single crystal silicon, respectively. Continued improvements in the efficiencies of diffused p-n junction cells were made; efficiencies of 10.3 and 9% were obtained for polysilicon cells of 1- and 20-cu cm sizes, respectively. The effects of grain boundaries on the generation of photocurrent were studied. The Hall mobility of polysilicon in the dark and under illumination, developed a served resistivity and mobility results. A comparison of the spectral response curves of SnO2/n-Si heterojunction and diffused p/n junction cells indicates a lower diffusion length in the diffused cells. The stability studies of the SnO2/n-Si cells were continued. DOE

N80-26829# Florida Univ., Gainesville. Coll. of Engineering.
PHYSICAL MODELS OF THIN FILM POLYCRYSTALLINE SOLAR CELLS BASED ON MEASURED GRAIN-BOUNDARY AND ELECTRONIC-PARAMETER PROPERTIES Final Report, 18 Sep. 1978 - 31 Dec. 1979
F. A. Lindholm, J. G. Fossum, P. A. Holloway, A. Neugroschel, J. A. Smazer, S. C. Pao, P. Russell, and M. A. Shibib 1979 18 p refs
(Contract ET-78-C-01-3421)
(DSE-3421-T1) Avail: NTIS HC A02/MF A01

The identification and characterization of the basic photovoltaic mechanisms that govern the conversion efficiency of polycrystalline thin-film solar cells, the experimentally determined electronic parameters related to photovoltaic mechanisms, and the relationship of the mechanisms and parameters to the conversion efficiency through theoretical physical models developed for engineering design are discussed. The theory of grain boundary and intragrain boundary recombination in polysilicon is presented. DOE

N80-26830# General Electric Co., Philadelphia, Pa. Space Div.
CONCENTRATING ARRAY PRODUCTION PROCESS DESIGN. VOLUME 1: STUDY SUMMARY. VOLUME 2: STUDY RESULTS Final Report
Ronald C. Hodge, A. Koeing, A. Hetzel, J. Nichols, A. Zucker, M. McCullough, R. Fogaroli, R. McCarthy, R. Drummond, and J. Dougherty Mar. 1980 213 p refs Prepared for Sandia Labs, Albuquerque, N.M.
(Contract EY-76-C-04-0789)
(SAND-78-7072-Vol-1/2) Avail: NTIS HC A10/MF A01

Existing P/V concentrator designs are evaluated in terms of their performance and low production and life cycle cost potential. Alternate designs and modifications are defined that will be potentially less costly to produce in large scale production. Manufacturing processes commensurate with four levels of production are defined for a prime array design. Manufacturing and life cycle costs are determined as a function of production level, category, and salient design features, e.g., optical type. DOE

N80-26831# Hanford Engineering Development Lab., Richland, Wash.
MATERIALS ANALYSIS METHODS FOR EXAMINATION OF SOLAR CELLS
C. N. Wilson, comp. Mar. 1980 97 p refs
(Contracts EY-76-C-14-2170; DE-AC14-76FF-02170)
(HEDL-6694) Avail: NTIS HC A05/MF A01

Photovoltaic device performance depends on properties of thin surface and near surface layers of solid state materials. Cell structures investigated for solar cells typically involve one or more thin film layers of semiconducting material. The chemical and physical structure of these layered material systems affects photovoltaic cell performances. In particular, the composition, abruptness, and chemical nature of layer interfaces are important. Also of interest is the degree of crystallinity, grain size and orientation, and the physical nature of grain boundaries within the various layers. Comprehensive examination of the structure and chemistry of photovoltaic materials requires application of several analysis methods. An overview of materials analysis methods and a summary of capabilities of several methods available are presented. DOE

N80-26832# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
ADVANCED DEVELOPMENT OF A SHORT RESIDENCE-TIME HYDROGASIFIER Quarterly Technical Progress Report, 1 Apr. - 30 Jun. 1979
Aug. 1979 181 p refs
(Contract ET-78-C-01-3125)
(FE-3125-8; QTPR-3) Avail: NTIS HC A09/MF A01

The design, construction, and operation of a hydrogasifier reactor for commercial application is discussed. The tests were performed at three quarter tons per hour and then at 4 tons per hour. Injection element scaling was investigated by studying single element and clustered multiple element injections at a sufficient magnification factor. Subbituminous coal was used in the test proceedings. Nitrogen usage and cooling tower require-

ments were lower than expected. The lower nitrogen usage reduced the heat load on the product gas cooler as less water was formed in the reactor. B.D.

N80-26832# Institut Francais de l'Energie, Paris.
GUIDE FOR ENERGY COMPATIBILITY
M. J. Braun and J. Lefebvre May 1979 160 p refs In FRENCH
(NP-24016; Rept-65) Avail: NTIS (US Sales Only) HC A08/MF A01; DOE Depository Libraries

A guide for the energy manager in the acquisition and processing of data necessary for energy conservation is presented. Energy conservation is defined and its objectives outlined. The principles and characteristics of measurement devices used are given. The use of the measurements in the establishment of energy balances is described. Examples are given of establishments that have instituted energy conservation plans. Tables are presented of comparative characteristics, by manufacturer and by type of measurement device, for 300 manufacturers operating in the French market. DOE

N80-26834# EIC, Inc., Newton, Mass.
ELECTRODEPOSITION OF POLYCRYSTALLINE AND AMORPHOUS SILICON FOR PHOTOVOLTAIC APPLICATIONS Quarterly Progress Report, 11 Jun. - 10 Sep. 1979
R. D. Rauh Nov. 1979 20 p refs
(Contract DE-AC03-79ET-23046)
(DOE/ET-23046/1; QPR-1) Avail: NTIS HC A02/MF A01

The design, construction, and testing of two cells for low and high temperature electrodeposition of silicon is described. The glass, low temperature cell for use with organic solvents incorporates the advantageous features of a small cell volume. Several survey experiments were made with the glass cell using SiHCl3 and SiCl(CH3)3 as the silicon precursors. Use of the former with AgCl/Ag as the reference electrode resulted in decomposition of the reference resulting in plating of silver on the electrode. It was also determined that LiAsF6 is not usable as the supporting electrolyte with SiHCl3. The cyclic voltammogram of the SiCl(CH3)3 solution showed two reduction peaks, but no indication of silicon deposition was observed. The high temperature cell for electrodeposition from molten salts was made from a nickel tube fitted with a lid using vacuum components to allow inlets for the electrodes, a pumping port, helium bubbler, and thermocouple. The salt mixture is contained in a molybdenum crucible. DOE

N80-26835# Los Alamos Scientific Lab., N. Mex.
VALIDATION OF SOLAR SYSTEM SIMULATION CODER BY THE INTERNATIONAL ENERGY AGENCY
James C. Hedstrom and Thomas L. Freeman (Atlas Corp., Santa Cruz, Calif.) 1980 7 p refs Presented at 2nd Ann. Systems Stimulation and Econ. Analysis Conf., San Diego, Calif., 23-25 Jan. 1980
(Contract W-7405-eng-36)
(LA-UR-80-387; CONF-800101-18) Avail: NTIS HC A02/MF A01

Validation of active solar energy system simulation codes by the International Energy Agency using data from the Los Alamos Study Center is described. Two rounds of comparisons of predicted to measure performance were completed. In the first round, all participants were given detailed system description data and a period of measured hourly weather and loads data with the corresponding measured hourly performance data. In the second round, the participants were given minor changes to the system description and a second period of measured hourly performance. In the first round, each of the participants was able to predict the results provided. However, this required an undocumented series of adjustments to the user input and the models and comparisons of measured and predicted results. Agreement of measured and predicted results were nearly as good in the second round except for two codes that predicted significantly erroneous results. As a result of this exercise, errors and shortcomings were found and corrected in most of the codes and confidence in the ability of all codes to model real systems has been increased. However, the questions of a workable methodology for validation and the means of dealing with user error remain unanswered. DOE

N80-26836# Department of Energy, Washington, D. C. Office of Energy Research.
PRELIMINARY ENVIRONMENTAL ASSESSMENT FOR THE SATELLITE POWER SYSTEM (SPS), REVISION 1. VOLUME 2: DETAILED ASSESSMENT
Jan. 1980 205 p refs
(DOE/ER-00362-Vol-2) Avail: NTIS HC A10/MF A01

The satellite power system (SPS) collects solar energy through a system of satellites in space and transfers this energy to Earth. A reference system is described that converts the energy to microwaves and transmit the microwave energy via directive antennas to large receiving/rectifying antennas (rectennas) located on the Earth. At the rectennas, the microwave energy is converted into electricity. The key environmental issues associated with the SPS which concern human health and safety, ecosystems, climate, and electromagnetic systems interactions are addressed. Microwave-radiation health and ecological effects; nonmicrowave health and ecological effects; atmospheric effects; effects on communication systems due to ionospheric disturbance, and electromagnetic compatibility are among the factors discussed. DOE

N80-26837# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.
DEMONSTRATION SALT GRADIENT SOLAR POND Ph.D. Thesis
Federica Zangrando and H. C. Bryant 10 Jul. 1979 149 p refs
(Contract EG-77-S-04-3977)
(ALO-3977-T1; SAPR-4) Avail: NTIS HC A07/MF A01

A thorough account is given of a solar pond study underway at the University of New Mexico since 1975. This report consists of the Ph.D. dissertation of Federica Zangrando entitled Observation and Analysis of a Full-Scale Experimental Salt Gradient Solar Pond. The stability condition for a nonconstant gradient, doubly-diffusive system is derived and a precription for the routine detection of potential instabilities is presented. Techniques for handling unstable regions are described. Conclusions so far strongly support the viability of the solar pond concept. Salt gradient ponds appear to have a very definite niche in the ecology of energy production. DOE

N80-26838# State Univ. of New York, Buffalo. Electrical Engineering Dept.
DEPOSITION, FABRICATION AND ANALYSIS OF POLYCRYSTALLINE SILICON MIS SOLAR CELLS Quarterly Technical Progress Report, 1 Jul. - 30 Sep. 1979
Wayne A. Anderson 30 Oct. 1979 54 p refs
(Contract DE-AC03-79ET-23044)
(DOE/ET-23044/T3; QTPR-3) Avail: NTIS HC A04/MF A01

A computer model was established to predict MIS solar cell performance as a function of semiconductor and solar cell design parameters. The solar cell fabrication procedure was modified to more carefully examine the effect of t/sub ox/. An oxide growth temperature of 550 to 600 C was shown to give good values of FF, V sub oc, and J sub sc which gave efficiency values consistently in the 9 to 10% range on Xtal-Si and 6.5 to 7.5% range on poly-Si. This revised process increased the average solar cell efficiency but did not increase maximum efficiency due to other parameters which were not optimum. I-V data for 77 K < T < 400 K were obtained for MIS solar cells on poly.-Si. Unpolished poly.-Si was shown to give space charge limited conduction indicative of a Gaussian trap distribution. Polished poly.-Si gave a tunneling mechanism at low temperatures and tunneling via interface states at higher temperatures. Electron beam deposition of thin (20 microns) Si films on Al coated stainless steel was resumed during this quarter. These films showed good adhesion to the metal substrate SEM studies revealed columnar growth with 5 microns dia columns. Radiation effect studies on MIS solar cells revealed an increased interface state density for proton and electron-irradianced solar cells. Auger studies on an oxide-covered Si surface reveal a mixture of silicon oxide and oxygen atoms chemisorbed to the Si surface (WHK). DOE

N80-26839# Arizona Public Service Co., Phoenix.
AIRPORT SOLAR PHOTOVOLTAIC CONCENTRATOR PROJECT, PHASE 1 Final Report, 1 Jun. 1978 - 28 Feb. 1979

Dec. 1979 347 p Prepared in cooperation with Motorola, Inc., Scottsdale, Ariz.
(Contract ET-78-C-04-5317)
(DOE/CS-05317/1) Avail: NTIS HC A15/MF A01

The system design, analysis, and specification, site preparation, and operation and evaluation plan for a 500 kWe photovoltaic power supply to be located at the Phoenix Sky Harbor International Airport in Phoenix, Arizona, are presented. The solar cell arrays are concentrator silicon solar cells with tracking 70X Cassegrain-type concentrators. The power conditioning system, tracking system, and control systems are described. Environmental impact studies are described. Component specifications and drawings are included. DOE

N80-26840# Argonne National Lab., Ill. Solar Applications Group.
DESIGN AND INSTALLATION MANUAL FOR THERMAL ENERGY STORAGE
Roger L. Cole, Kenneth J. Nield, Raymond R. Rohde, and Ronald M. Wolosewicz Jan. 1980 381 p refs
(Contract W-31-109-eng-38)
(ANL-79-15-Ed-2) Avail: NTIS HC A17/MF A01

The design and installation of thermal energy storage in active solar systems is discussed. Both air based and liquid based systems are covered with topics on designing rock beds, tank types, pump and fan selection, installation, costs, and operation and maintenance. Topics relevant to latent heat storage include properties of phase change materials, sizing the storage unit, insulating the storage unit, available systems, and cost. Topics relevant to heating domestic water include safety, single-, and dual-tank systems, domestic water heating with air and liquid based space heating systems, and stand alone domestics hot water systems. Also examined are common problems with storage systems and their solutions, heat transfer fluid properties, economic insulation thickness, heat exchanger sizing, and sample specifications for heat exchangers, wooden rock bins, steel tanks, concrete tanks, and fiberglass reinforced plastic tanks. DOE

N80-26841# Battelle Columbus Labs., Ohio.
DEVELOPMENT OF A LOW-TEMPERATURE, LOW-COST, BLACK LIQUID SOLAR COLLECTOR, PHASE 2 Semiannual Report, 1 Sep. 1979 - 29 Feb. 1980
D. K. Landstrom, S. G. Talbert, and V. D. McGinniss 20 Mar. 1980 24 p refs
(Contract DE-AC04-79CS-30171)
(ALO-30171-1) Avail: NTIS HC A02/MF A01

The long-term durability of various plastic materials and solar collector designs was evaluated and sufficient outdoor performance data to design a full-scale demonstration of a black-liquid solar collector for a commercial application were obtained. Besides conducting indoor weathering tests of various plastic materials, two outdoor automated test facilities were built. One unit was in use for about two winter months in Columbus, Ohio, and the other unit is ready for testing in Phoenix, Arizona. Extruded polycarbonate panels and extruded acrylic panel designs were investigated. DOE

N80-26842# Department of Energy, Washington, D. C. Office of Solar Applications for Buildings.
SOLAR FEDERAL BUILDINGS PROGRAM PLAN
Feb. 1980 27 p
(DOE/CS-0147A) Avail: NTIS HC A03/MF A01

The Solar Federal Buildings Program (SFBP) is a multi-year program designed to stimulate the growth and improve the efficiency of the solar industry by providing funds to Federal agencies for the design, acquisition, construction, and installation of commercially applicable solar hot water, heating, cooling, and process systems in new and existing Federal buildings. The program plan to be used in implementing this major solar commercialization effort is outlined. DOE

N80-26843# Brookhaven National Lab., Upton, N. Y.
DEVELOPMENT OF HARDWARE SIMULATORS FOR TESTS OF SOLAR COOLING/HEATING SUBSYSTEMS AND SYSTEMS. PHASE 2: UNSTEADY RATE HARDWARE SIMULATION OF RESIDENTIAL ABSORPTION CHILLER
Paul C. Auh Sep. 1979 29 p refs
(Contracts EY-76-C-02-0016; DE-AC02-78CH-00016)
(BNL-51121) Avail: NTIS HC A03/MF A01

Transient and cycling performance characteristics of an advanced solar absorption chiller were determined. Laboratory tests of the second generation Arkla chiller (Solaire 36, model WF36), using the BNL simulator, were performed. Chiller performance was measured against fast and slow cycling periods under both the conventional and modified control modes. The degree of performance improvement under the modified control mode, as a function of the cycle period and such effects on the integrated chiller performance, was thoroughly investigated. DOE

N80-26844# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
LOW-COST SOLAR ANTIREFLECTION COATINGS Annual Report, 24 Jul. 1978 - 24 Sep. 1979
R. J. H. Lin, J. C. Lee, and P. B. Zimmer Oct. 1979 99 p refs
(Contracts EM-78-C-04-5300; DE-AC04-78CS-35300)
(ALO-5300-T2) Avail: NTIS HC A05/MF A01

The etched antireflection (AR) coating process was scaled up to etch full size glass panes but the chemical control of the etching solution remains a problem. Analytical methods including high pressure liquid chromatography (HPLC), flame excited atomic absorption, infrared spectroscopy, Coulter counter techniques, and liquid index of refraction measurements were examined for application to this process monitor and control problem. A phenomenological model for the key reaction species in the etching process is presented along with a monitor control scheme using refractive index measurements to set the initial reactant concentrations and HPLC to track in process concentrations. The environmental durability of the organic AR coating of fused FEP-120 Teflon dispersion was improved by the use of a hydrofluoric acid etch/silane coupling agent pretreatment. Improved coating processing technique were developed culminating in the demonstration of scale up feasibility for glass panels up to 1 ft by 1 ft with good batch sample to sample repeatability. DOE

N80-26845# EIC, Inc., Newton, Mass.
CORROSION PROTECTION OF SOLAR-COLLECTOR HEAT EXCHANGERS WITH ELECTROCHEMICALLY DEPOSITED FILMS Semiannual Report, 1 Dec. 1978 - 31 May 1979
S. B. Brummer, V. R. Koch, and G. H. Schnaper Jul. 1979 44 p refs
(Contract EM-78-C-04-4297)
(COO-4297-2; SAR-2) Avail: NTIS HC A03/MF A01

A novel corrosion protection technique was demonstrated for the common solar collector metals Al, Cu, and Fe as mild steel. This involves the potentiostatic electrochemical deposition of thin, adherent polymer films on the interior of heat exchanger tubes by application of a current in the presence of a suitable organic monomer. Polyphenylene oxide (PPO) films were anodically deposited onto Al, Cu and Fe coupons from methanolic media. However, defects in these films afforded poor corrosion protection. Suitably functionalized PPO films have been crosslinked via Schiff base formation in a subsequent chemical step. While these chemically modified PPO films were demonstrably more resistant to ethylene glyco H2O media at elevated temperatures, they too were undetermined by the thermal transfer medium. Cinnamaldehyde, a styrene type monomer, has been successfully electrodeposited onto Al coupons. This process involved a constant, albeit unreferenced potential technique in which the Al is made the negative electrode. DOE

N80-26846# International Business Machines Corp., Huntsville, Ala. Federal Systems Div.
COLLECTOR ARRAY PERFORMANCE REPORT FOR SITES OF THE NATIONAL SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM
Jul. 1979 146 p
(Contract EG-77-C-01-4049)
(SOLAR/0021-79/07) Avail: NTIS HC A07/MF A01

The following data are given: (1) single-panel instantaneous efficiency curve coefficients; (2) current month instantaneous efficiency curve coefficients; (3) cumulative (through current month) instantaneous efficiency curve coefficients; (4) cumulative (through current month) second order curve coefficients; (5) daily

energy gain comparisons for the current month; (6) properties of the collector transport fluid; (7) array flow rate (average for the month); (8) single panel flow rate; (9) array temperature gain (average for the month); and (10) monthly energy gain comparisons for the most recent 12 months. DOE

N80-26847# Los Alamos Scientific Lab., N. Mex.
ADDITIONAL SOLAR/LOAD RATIO CORRELATIONS FOR DIRECT GAIN BUILDINGS
William O. Wray 1980 6 p refs Presented at the Ann. Meeting of the Am. Sect. of ISES, Phoenix, Ariz., 2-6 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-854; CONF-800604-2) Avail: NTIS HC A02/MF A01

Solar/load ratio (SLR) correlations were developed for two new reference direct gain designs. The new reference designs are identical to the originals except that the glazing air gap has been increased from 1/4 in. to 1/2 in. and a vector average of the local hourly windspeed was used in the thermal network calculations rather than an assumed average value of 15 mph. Both of these modifications are realistic and enhance the predicted performance of direct gain buildings. A comprehensive set of mass sensitivity calculations was performed in order to provide information needed to select an appropriate set of parameters for new lightweight direct gain designs for which additional SLR correlations will be developed. DOE

N80-26848# Northrop Services, Inc., Huntsville, Ala.
EVALUATION OF HEAT TRANSFER ENHANCEMENT IN AIR-HEATING COLLECTORS Final Report
Donald L. Mattox Jun. 1979 187 p refs
(Contracts EM-78-C-04-5352; DE-AC04-78CS-05352)
(ALO-5352-T1) Avail: NTIS HC A09/MF A01

Increasing the thermal efficiency of air heating solar collectors through identification and development of optimum design and operation criteria for solar absorber to air heat exchangers is reported. A transient heat transfer analysis of a complete solar air heating collector was used to demonstrate that an optimum absorber to air heat exchanger design could be provided with several interrupted fin configurations. Additional analyses were performed to establish that the maximum solar collector thermal performance to required pumping power was realized for a Reynolds number range of 1000 to 2000. This Reynolds number range was used to establish a theoretical design limit curve for maximum thermal performance versus required pumping power for all interrupted fin designs as published in the open literature. Heat and momentum transfer empirical relationships were defined for scaling the state of the art high conductance fin designs identified from a compact configuration for the less compact designs needed for solar collectors. DOE

N80-26849# Midwest Research Inst., Golden, Colo.
END-USE MATCHING FOR SOLAR INDUSTRIAL PROCESS HEAT Final Report
Kenneth C. Brown, Douglas W. Hooker, Ari Rabl, Shirley A. Stadjuhar, and Ronald E. West Jan. 1980 235 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-34-091) Avail: NTIS HC A11/MF A01

Because of the large energy demand of industry (37% of US demand) and the wide spectrum of temperatures at which heat is required, the industrial sector appears to be very suitable for the matching of solar thermal technology with industrial process heat (IPH) requirements. A methodology for end-use matching was devised, complete with required data bases and an evaluation program PROSYS/ECONMAT. Six cities in the United States were selected for an analysis of solar applications to IPH. Typical process heat requirements for 70% of the industrial plants in each city were identified and evaluated in conjunction with meteorological and economic data for each site to determine lowest cost solar systems for each application. The flexibility and scope of PROSYS/ECONMAT is shown in a variety of sensitivity studies that expand the results of the six city analysis. Case studies of two industrial plants were performed to evaluate the end use matching procedure, these results are reported.DOE

N80-26850# Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
CUPROUS OXIDE PHOTOVOLTAIC CELLS Final Report, 1 Sep. 1978 - 30 Nov. 1979
D. Trivich 1979 57 p refs
(Contract ET-78-S-02-4726)
(COO-4726-1-T1) Avail: NTIS HC A04/MF A01

The research described represents the beginning of a second phase of research on cuprous oxide photovoltaic cells. The first phase was concerned with the development of procedures of making Schottky barriers on isolated films of Cu2O, including single crystals. It was found that properties of these Schottky barrier cells, in particular the barrier heights, were limited by chemical changes at the junction especially with metals of low work function which tend to be more active chemically, e.g., Al. The motivation of the present phase of the research was to construct junctions that would avoid this chemical degradation while maintaining electrical contact between the Cu2O and a low work function material in order to attain larger barrier heights. Essentially the approach involved placing the Cu2O in contact with a stable oxide. When this oxide is used as a thin layer between the Cu2O and a top metal contact this gives an MIS structure. As another approach, the other oxide can be an n-type semiconductor in thicker layers to form a heterojunction. Results are reported. DOE

N80-26851# Tennessee Technological Univ., Cookeville.
WIND EFFECTS ON COLLECTORS Final Report, 1 Oct. 1978 - 1 Oct. 1979
Hudy C. Hewitt, Jr. and Edwin I. Griggs 1 Nov. 1979 113 p refs
(Contract EM-78-C-04-5364)
(DOE/CS-35364/T1) Avail: NTIS HC A06/MF A01

Consideration was given to modeling wind speed data and to a scheme for correlating data between two separate stations. A sensor system was developed to measure the effect of wind on collector performance. The specifications for the sensor are presented, and a discussion of the calibration of the sensor is given. Four experiments were performed to determine wind flow patterns around buildings. The velocity profile over an actual collector was also measured as a function of free stream velocity. A mathematical model for a solar collector and three experimental efforts to measure the effect of wind on collector performance are reported. DOE

N80-26852# Northwestern Univ., Evanston, Ill.
STUDIES OF METAL: SEMICONDUCTOR INTERFACES IN CATALYSIS AND ENERGY CONVERSION Annual Report, 15 Jun. 1979 - 14 Jun. 1980
Y. W. Chung Mar. 1980 27 p refs
(Contracts ER-78-S-02-4946; DE-AC02-78ER-4946)
(COO-4946-2) Avail: NTIS HC A03/MF A01

Experimental capabilities were enhanced by the incorporating of an Al/Mg K alpha X-ray source for X-ray photoemission studies, a micro-computer for data acquisition and analysis, an isolation cell attachment to the UHV surface analysis chamber for performing high pressure chemical reaction studies, a high intensity UV light source for photochemical studies, and finally an ultra-sensitive quartz crystal thickness monitor for controlled metal deposition. A method was developed to measure the chemical state of ad-atoms on semiconductor surfaces using X-ray photoemission. Using such a technique, it was found that the Pt atoms in contact with the SrTiO3 (100)-(1x1) surface acquire a negative charge, viz 0.6 electron/Pt-atom. By studying the line shape changes of the Ti 2p core levels, it was found that the charge transfer is via the Ti(3+) oxygen vacancy complexes on the SrTiO3 surface. DOE

N80-26853# Aerojet Energy Conservation Co., Sacramento, Calif.
MULTI-MEGAWATT ORGANIC RANKINE ENGINE POWER PLANT (MORE) PHASE 1A: SYSTEM DESIGN OF MORE POWER PLANT FOR INDUSTRIAL ENERGY CONSERVATION EMPHASIZING THE CEMENT INDUSTRY Final Report, 15 Sep. 1978 - 30 Sep. 1979
E. K. Bair, B. Breindel, F. N. Collamore, J. N. Hodgson, and G. K. Olson 31 Jan. 1980 94 p refs
(Contract DE-AC03-78ET-12434)
(DOE/ET-12434/T1) Avail: NTIS HC A05/MF A01

The Multi-Megawatt Organic Rankine Engine (MORE) program is directed towards the development of a large, organic Rankine

power plant for energy conservation from moderate temperature industrial heat streams. Organic Rankine power plants are ideally suited for use with: heat sources in the temperature range below 1100 F. Cement manufacture was selected as the prototype industry for the MORE system because of the range of parameters which can be tested in a cement application. This includes process exit temperatures of 650 F to 1110 F for suspension preheater and long dry kilns, severe, dust loading, multi-metawatt power generation potential, and boiler exhaust gas acid dew point variations. The work performed during the Phase 1A System Design contract period is described. The System Design task defines the complete MORE system and its installation to the level necessary to obtain detailed performance maps, equipment specifications, planning of supporting experiments, and credible construction and hardware cost estimates. The MORE power plant design is based upon installation in the Black Mountain Quarry Cement Plant near Victorville, California. DOE

N80-26854# SRI International Corp., Menlo Park, Calif.
APPLICATION OF MICROFABRICATION TECHNOLOGY TO THERMIONIC ENERGY CONVERSION Progress Report, 1 Nov. 1979 - 31 Jan. 1980
Ivor Brodie and Duane C. Gates 10 Mar. 1980 12 p refs
(Contract DE-AC02-79ET-15423; SRI Proj. 8558)
(DOE/ET/15423-2; PR-2) Avail: NTIS HC A02/MF A01

Two diode designs are studied that required different fabrication techniques. The fabrication of electrodes was begun to test the concepts and the feasibility of these designs. This work was done with polished molybdenum electrode surfaces and vapor-deposited alumina insulator structures. Initial results were obtained in the close spacing of molybdenum electrodes with alumina insulators. Spacings were demonstrated with 1/2-inch diameter discs in the range of 3 to 5 micron m, using 1-micro m thick insulators. The deposition of thin alumina films on a molybdenum substrate was demonstrated, upon which arrays of thin film electrodes about 1/32-inch in diameter were deposited. A second approach uses a thin film as one of the electrodes. An analysis of the thermal and electrical transport properties of 1-micro m thick tungsten film shows that edge-connected films about 1 mm square in area could withstand the stresses generated by differential thermal expansion when the film is attached to the opposite electrode by stand-off insulators. DOE

N80-26855# Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
DESIGN OF ANNUAL STORAGE SOLAR SPACE HEATING SYSTEMS
F. C. Hooper and J. D. Cook Nov. 1979 13 p refs Presented at the 72nd Ann. AICHE Meeting, San Francisco, 25-29 Nov. 1979 Submitted for publication
(Contract EY-76-C-02-2939)
(DOE/CS-32939/10; CONF-791108-20) Avail: NTIS HC A02/MF A01

A simulation model for the performance of such systems is described, and a method of classifying system configurations is proposed. It is shown that annual systems sized for unconstrained performance, with no unused collector or storage capacity, and no rejected heat, minimize solar acquisition costs. The optimal performance corresponds to the condition where the marginal storage-to-collector sizing ratio is equal to the corresponding marginal cost ratio. DOE

N80-26856# Sandia Labs., Livermore, Calif. Materials Science Div.
SIGMA PHASE FORMATION IN ALLOYS FOR SO2/SO3 THERMAL ENERGY STORAGE SYSTEMS
D. A. Hughes Feb. 1980 39 p refs
(Contract EY-76-C-04-0789)
(SAND-80-8205) Avail: NTIS HC A03/MF A01

A screening test was completed which identifies the tendency for sigma phase formation in alloys for SO2/SO3 thermal energy storage systems. The candidate alloys include austenitic and ferritic stainless steels, Fe-Ni Base, and Ni base alloys. Test specimens were aged for 4,000 hours at ambient temperature, 700, 800, 900, and 1000 C. Aged specimens were tested for Charpy V-notch toughness. Decreases in toughness upon aging correlated well with the observed changes in microstructure. DOE

N80-26857# Sandia Labs., Albuquerque, N. Mex. Advanced Energy Projects Div.
AERODYNAMIC PERFORMANCE OF THE 17-M-DIAMETER DARRIEUS WIND TURBINE IN THE THREE-BLADED CONFIGURATION: AN ADDENDUM
Mark H. Worstell Feb. 1980 59 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1753) Avail: NTIS HC A04/MF A01

The US Department of Energy (DOE)/Sandia 17-m wind turbine has been tested in the three bladed configuration at five rotational speeds. These data are presented along with some fundamental comparisons to the earlier two bladed results. Also included is the theoretical output of the three bladed 17-m turbine at two selected rotational speeds. DOE

N80-26858# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
ENERGY FOR WIND POWERED OSCILLATORS Semiannual Technical Progress Report, 1 Aug. 1979 - 31 Jan. 1980
Patrick J. Starr 1980 10 p refs
(Contract DE-FG02-79R5-10129)
(DOE/R5/10129-1) Avail: NTIS HC A02/MF A01

Information is presented concerning a literature review on flow induced vibrations; an estimation of available power; design procedure for both votex shedding and galloping; and conversion schemes. DOE

N80-26859*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERNATIONAL PHOTOVOLTAIC PROGRAM. VOLUME 2: APPENDICES
Dennis Costello, Robert Koontz, David Posner, Patricia Heiferling, Paul Carpenter, Sylvia Forman, and Lewis Perelman Dec. 1979 218 p refs Prepared jointly with Midwest Research Inst., Golden, Colo., Massachusetts Inst. of Technol. Cambridge and Illinois Inst. of Technol., Chicago 2 Vol.
(Contract EG-77-C-01-4042)
(NASA-CR-163339) Avail: NTIS HC A10/MF A01

The results of analyses conducted in preparation of an international photovoltaic marketing plan are summarized. Included are compilations of relevant statutes and existing Federal programs; strategies designed to expand the use of photovoltaics abroad; information on the domestic photovoltaic plan and its impact on the proposed international plan; perspectives on foreign competition; industry views on the international photovoltaic market and ideas about the how US government actions could affect this market;international financing issues; and information on issues affecting foreign policy and developing countries. DOE

N80-26860# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
BASELINE DESIGN OF AN OTEC PILOT PLANTSHIP. VOLUME A: DETAILED REPORT
J. F. George, D. Richards, and L. L. Perini May 1979 437 p refs
(Contract EG-77-A-29-1076)
(DOE/CS-1076/2-Vol-A; APL/JHU/SR-78-3A) Avail: NTIS HC A19/MF A01

A baseline design of an ocean thermal energy conversion (OTEC) pilot plantship was developed. The baseline design features a platform that is configured to produce up to 20 MW(e) (net) power, using low cost folded-tube aluminum heat exchangers, while it grazes slowly in tropical waters where the thermal gradient is greatest and the ocean environment is least severe. The design rationale, important calculations, for future work, and a study of system costs are discussed. DOE

N80-26861# Department of Energy, Washington, D. C. Office of Energy Technology.
SOLAR, GEOTHERMAL, ELECTRIC AND STORAGE SYSTEMS PROGRAM SUMMARY DOCUMENT, FY 1980
Jul. 1979 449 p Sponsored by DOE
(DOE/ET-0102) Avail: NTIS HC A19/MF A01

Current and planned programs in solar technology, geothermal energy, electric energy systems, and energy storage systems

are covered. After national energy policy with respect to these programs is introduced, the program structure. FY 1980 budget request, strategies, and management are identified. For each energy technology program, activity areas are described and their status outlined. Program aspects which crosscut all energy technologies (e.g., regional activities, commercialization, environmental and socioeconomic aspects, small and minority business utilization, and international programs) are described. DOE

N80-26862# Department of Energy, Washington, D. C. Div. of Energy Storage Systems.
THERMAL AND MECHANICAL ENERGY-STORAGE PROGRAM, PROJECT SUMMARY DATA FY 1980
1980 196 p Sponsored by DOE
(DOE/CS-0150) Avail: NTIS HC A09/MF A01

The Department of Energy's Division of Energy Storage Systems (STOR) is supporting a broad range of projects to conserve energy and to make possible shifting away from oil and natural gas by developing new and/or improved energy storage systems applicable to central power generation dispersed power generation, solar and waste heat utilization, and vehicle propulsion. These programs include: Thermal Energy Storage; Chemical/Hydrogen Energy Storage; Mechanical and Magnetic Energy Storage; and Underground Energy Storage. Technical and Economic Analysis is supported concurrently to evaluate competitive energy storage options. This summary report addresses the above categories except for Technical and Economic Analysis. Thermal and Chemical/Hydrogen Energy Storage technologies offer the greatest potential for near term impact of all the storage technologies under development. During FY 80, STOR will commit nearly $32 million to the Thermal and Mechanical Energy Storage Program. The breakdown of budget authorized funding for FY 1979 and FY 1980 is shown. This publication consists principally of summary sheets for each active project in the Thermal, Chemical/Hydrogen, and Mechanical Energy Storage Program for FY 1979. DOE

N80-26863# Brookhaven National Lab., Upton, N. Y.
DEVELOPMENT OF HARDWARE SIMULATORS FOR TESTS OF SOLAR COOLING/HEATING SUBSYSTEMS AND SYSTEMS. PHASE 1: RESIDENTIAL SUBSYSTEM HARDWARE SIMULATOR AND STEADY STATE SIMULATION
Paul C. Auh Sep. 1979 29 p refs
(Contract EY-79-C-02-0016)
(BNL-51120) Avail: NTIS HC A03/MF A01

The proposed hardware simulator was successfully built and has been operational since its construction. The hardware simulator has the following unique features: it has been incorporated with a measurement double checking system, it is a totally closed loop system, it employs three separate energy storage tanks, and it has been automated to perform instantaneous data collection and reduction. With the external energy storage, all the external test conditions can be easily set up for any steady state or transient run. The simulator is described in detail with schematics and actual photographs. The steady state testing of Arkla's Solaire 36 absorption chiller has been performed. The test dealt primarily with chiller capacity or coefficient of performance as a function of generator hot water inlet temperature (1) with condenser cooling water inlet temperature as parameter, and (2) with evaporator chilled water outlet temperature as parameter. DOE

N80-26864# Franklin Research Center, Philadelphia, Pa.
SYSTEM PLANNING ANALYSIS APPLIED TO OTEC: INITIAL CASES BY FLORIDA POWER CORPORATION, TASK 2
Mar. 1980 111 p ref Prepared for Florida Power Corp., St. Petersburg
(Contract DE-AC02-79ET-29187)
(DOE/ET/29187-2; FC-5237-2) Avail: NTIS HC A06/MF A01

The FPC system planning methodology was used on:(1) Base Case, 10 year generation expansion plan with coal plants providing base load expansion, and (2) same, but 400 MW of OTEC substituting for coal burning units with equal resultant system reliability. The OTEC inputs were based on reasonable economic projections of direct capital cost and O and M costs for first generation large commercial plants. The Base Case conditions for FPC system planning methodology involved base load coal fueled additions during the 1980's and early 1990's. The first trial runs of the PROMOD system plannung model substituted OTEC for 400 MW purchases of coal generated power during 1988-1989 and then 400 MW coal capacity thereafter. Result showed higher system reliability than Base Case runs. Production costing computer model runs were used as input to Corporate Model to examine corporate financial impact. Results show present value of total revenue requirements unfavorable to OTEC as compared to coal units. DOE

N80-26865# Oregon State Univ., Corvallis. School of Oceanography.
EXPOSURE: A NEWSLETTER FOR OCEAN TECHNOLOGISTS, VOLUME 8, NO. 1
Rod Mesecar Mar. 1980 8 p
(AD-A083941) Avail: NTIS HC A02/MF A01 CSCL 10/3

Dramatic progress has been made in the development of high performance batteries in recent years. Much of this development effort has concentrated on lithium-based batteries. The reason for the interest in lithium is that it has the highest potential of the metals in the electromotive series. Consequently, the theoretical energy density of lithium-based electrochemical couples is higher than other couples. As a result of research and development efforts carried out in industry and in government laboratories, the potential benefits of lithium-based batteries are now being realized in practical hardware. Lithium-sulfur and lithium-halogen couples are being developed for secondary (rechargeable) battery applications and lithium-thionyl chloride, lithium-sulfur dioxide, and lithium-vanadium pentoxide are the better known couples being developed for primary (nonrechargeable) battery applications. Comparisons of two representative examples of lithium battery electrochemistry, namely lithium sulfur dioxide (LiSO2) and lithium thionyl chloride (LiSOCl2) are made with other primary battery power sources. GRA

N80-26866# Research Triangle Inst., Research Triangle Park, N. C.
APPLICATION ANALYSIS AND PHOTOVOLTAIC SYSTEM CONCEPTUAL DESIGN FOR SERVICE/COMMERCIAL/INSTITUTIONAL AND INDUSTRIAL SECTORS. VOLUME 2: TECHNICAL REPORT Final Report
R. A. Whisnant, C. B. Morrison, N. G. Staffa, and R. D. Alberts Dec. 1979 219 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7020-Vol-2) Avail: NTIS HC A10/MF A01

Data on the attributes of the applications that are germane to solar photovoltaic systems application were identified and acquired, and the figure of merit, utilizing the collected data, that indicates the relative photovoltaic potential for displacement of conventionally generated electricity of the various of applications were devised and applied. The expected profitability of photovoltaic application was determined from the discounted future costs of conventional energy sources, capital costs, and projected operating and maintenance costs over the life of the system. This was combined with the energy consumption of the application to obtain an estimte of the energy market potential. The application ranking and subjective evaluations of market size diversity, and public exposure were used to select five applications and their locations for design of a suitable photovoltaic system. For each of the selected applications, the various relevant characteristics are identified, potential photovoltaic system configurations are identified, and performance and economic models are used to design a representative system. DOE

N80-26867# Oak Ridge National Lab., Tenn. Solar and Special Studies Div.
PHOTOVOLTAIC APPLICATIONS: PAST AND FUTURE
Stephen I. Kaplan 1980 6 p Presented at the 14th Photovoltaics Specialists Conf., San Diego, Calif., 7 Jan. 1980
(Contract W-7405-eng-26)
(CONF-800106-4) Avail: NTIS HC A02/MF A01

Three planned or proposed photovoltaic projects are described. The 240 kWe system at Mississippi County Community College consists of an array of 270 106 unit strings of single crystal Si cells mounted at the focus of 40x concentrating parabolic troughs. The system is expected to be complete in the spring

of 1980. The four 50 kWp photovoltaic systems planned for Northwest Mississippi Junior College consist of different types of solar cells using different types of concentrators. The system is expected to go into operation in the summer of 1980. The proposed system for Georgetown University has not reached the hardware grant stage. DOE

N80-28868# Midwest Research Inst., Golden, Colo.
ANALYSIS METHODS FOR PHOTOVOLTAIC APPLICATIONS
[1980] 7 p
(Contract EG-77-C-01-4042)
(SERI/SP-35-230) Avail: NTIS HC A02/MF A01

Brief descriptions of a variety of photovoltaic power systems simulation models and design tools are given. Services available through photovoltaic module manufacturers are outlined, and computer codes for systems analysis are described. DOE

N80-28869# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PHASE 2 EXPERIMENT TEST PLAN: SOLAR PHOTOVOLTAIC/THERMAL RESIDENTIAL EXPERIMENT
Duncan B. Sheldon 23 Jan. 1980 27 p refs
(Contract EY-76-C-02-4094)
(COO-4094-65) Avail: NTIS HC A03/MF A01

The Solar Photovoltaic/Thermal Energy Project requires a Phase 2 test plan for its Solar Energy Research (SERF). This Phase 2 test plan is provided. The purpose of the research being conducted at the SERF is reviewed, and references describing Phase 1 work are listed. DOE

N80-28870# Los Alamos Scientific Lab., N. Mex.
PASSIVE SOLAR DESIGN HANDBOOK. VOLUME 2 OF TWO VOLUMES: PASSIVE SOLAR DESIGN
J. Douglas Balcomb, Dennis Barley, Robert McFarland, Joseph Perry, Jr., William O. Wray, and Scott Noll Jan. 1980 230 p
(Contract W-7405-eng-48)
(DOE/CS-0127/2) Avail: NTIS HC A11/MF A01

A manual for the design and performance evaluation and analysis of passive solar heating systems is presented. Two passive solar building types are analyzed: direct gain and thermal storage walls. Rules of thumb for the schematic design phase and simplified procedure for the design development phase are described. Analysis methods for the construction documents phase are given. The design procedure for fan-forced rock beds for hybrid systems is presented. Economic analysis methods for passive solar buildings are described. Tables of monthly average solar radiation, temperature and degree days for various locations in the US and southern Canada are included. DOE

N80-28871# Midwest Research Inst., Golden, Colo.
ANALYSIS METHODS FOR SOLAR HEATING AND COOLING APPLICATIONS: PASSIVE AND ACTIVE SYSTEMS, THE SECOND EDITION
Jan. 1980 19 p refs
(Contract EG-77-C-01-4042)
(SERI/SP-35-232R) Avail: NTIS HC A02/MF A01

Brief descriptions of analysis methods and design tools which are valuable in performing parametric studies of candidate designs are presented. The methods included range from rules-of-thumb for builders to the simulation packages used by researchers. DOE

N80-28872# Argonne National Lab., Ill. Energy and Environmental Systems Div.
RELIABILITY AND MAINTAINABILITY EVALUATION OF SOLAR CONTROL SYSTEMS
E. Waite, D. Patterson, L. Prucha, H. Singh, R. M. Wolosewicz, and P. S. Chopra Mar. 1979 48 p refs
(Contract W-31-109-eng-38)
(SOLAR/0903-79/70; ANL/SDP-TM-79-5) Avail: NTIS HC A03/MF A01

Control system problems affected the performance or reduced the effectiveness of 25 percent of the 47 DOE sponsored solar heating and cooling sites that were reviewed. The reliability field information presented indicates that most of the control system problems that were encountered so far were design related. The second major reason the systems experienced operating difficulties was improper sensor calibration, location, and installation. Defective components caused some operating problems, but the incidence of these problems was approximately one-third that of the design related problems. After an introductory look at control systems and terminology, control problems are presented in detail. Since the major control problem is design-related, a Failure Modes and Effects Analysis (FMEA) on two existing systems is presented. While the FMEA cannot be used to improve the design of these operational systems, the results can be used to critique the system and to indicate where improvements can be made in future systems. DOE

N80-28873# Department of Housing and Urban Development, Washington, D. C. Office of Policy Development and Research.
SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM: A DESCRIPTIVE SUMMARY OF HUD CYCLE 4 AND 4A SOLAR RESIDENTIAL PROJECTS
Jul. 1979 167 p
(Contract EX-76-A-29-1020)
(HUD-PDR-455) Avail: NTIS HC A08/MF A01

The US Department of Housing and Urban Development (HUD) has awarded nearly $8.5 million in grants for the purchase and installation of solar energy equipment in 6,851 residences. This cycle is fourth in a series of five cycles of residential demonstration projects with solar heating and cooling systems sponsored by HUD in a national effort to demonstrate widespread use of solar energy. Each project is summarized. The grantee and the location and size of the project are described. A rendering of the unit is given along with a description of energy system. DOE

N80-28874# Gruy Federal, Inc., Arlington, Va.
GEOTHERMAL DIRECT USE, ECONOMIC AND ENGINEERING STUDY INTEGRATION. VOLUME 1: METHODOLOGY AND RESULTS Final Report
Charles A. Bakewell, Neil Book, and E. Hunter Herron Aug. 1979 107 p
(Contract ET-78-C-03-2072)
(SAN-2072-1-Vol-1) Avail: NTIS HC A06/MF A01

The technical approach to the problem of comparative evaluation of the twenty economic-engineering studies on nonelectric uses of geothermal energy is described. The Geodec model is presented and the analyses made and the results calculated are described. The conclusions and recommendations arising from these results are discussed. Sample data input/output forms for each of the modules which make up Geodec and the detailed input data and calculated results for each process analyzed are included. DOE

N80-28875# Gruy Federal, Inc., Arlington, Va.
GEOTHERMAL DIRECT USE, ECONOMIC AND ENGINEERING STUDY INTEGRATION. VOLUME 2: DATA BASE Final Report
Charles A. Bakewell, Neil Book, and E. Hunter Herron Aug. 1979 375 p
(SAN-2072-1-Vol-2) Avail: NTIS HC A16/MF A01

Process analyses are presented including input and output data base for each of the twenty economic-engineering studies on nonelectric uses of geothermal energy identified. DOE

N80-28876# Entwicklungs- und Forschungslabor, Lorrach (West Germany).
WATER HEATING BY SOLAR ENERGY WITH PLASTIC COLLECTORS Final Report
Juergen Kleinwaecher Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1979 163 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-29) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 34

A low price, high efficiency, light weight, and easy to transport solar collector was developed using a plastic monotube with transparent top and dark bottom. Various synthetic materials were examined with regard to their optical and thermal properties and their durability. Prototype installations for swimming pool heating, domestic hot water and house heating in combination with a heat pump are described. Author (ESA)

N80-26877# Grammer (Wilibald), Amberg (West Germany). Abteilung Solar-Klima-Technik.
SOLAR COLLECTOR SYSTEM USING AIR COLLECTORS FOR A PRE-DRYING FACILITY IN A GRASS DRYING PLANT Final Report
Hermann Barthel Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1979 19 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(SKT-Teil-1; BMFT-FB-T-79-30) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 3,60

The design, construction, and installation of a solar collector system for the drying of grass with hot air is described. The collector surface measures 1456 square meters. Measurements were taken during field tests and their results are reported. Water removal is about 18%. Author (ESA)

N80-26878# AEG-Telefunken, Wedel (West Germany). Fachbereich Raumfahrt, Neue Technologien.
DESIGN AND FABRICATION OF TERRESTRIAL PHOTOVOLTAIC SOLAR GENERATORS FOR FIELD TESTING IN REGIONS OF INTENSIVE INSOLATION Final Report
Hans-Dieter Wegmann Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-34) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 7,15

The design and production of photovoltaic solar energy converters is described for three different applications: a transmitter station, a navigation buoy, and a laboratory building. The collectors consisted of interconnected 5 cm x 5 cm silicon solar cells encapsulated in glass or glass fiber reinforced acrylic resin. The largest device delivered 2000 W of electrical power. Author (ESA)

N80-26879# Austrian Solar and Space Agency, Vienna.
COLLECTOR TEST METHODS: ANALYSIS OF TEST METHODS FOR THE DETERMINATION OF THE THERMAL EFFICIENCY OF FLAT-PLATE COLLECTORS
Manfred Bruck, Walter Heindl, Harald Koch, Gottfried Schaffar (Technische Univ., Vienna), and Peter Varga Sep. 1979 236 p refs Sponsored by Austrian Federal Ministry of Science and Research
(ASSA-FA-10; ISBN-3-7041-0050-1) Avail: NTIS HC A11/MF A01

Test methods were evaluated for the determination of the thermal efficiency of flat-plate solar collectors with a liquid as the transfer fluid by means of a mathematical simulation. A comparison of experimental results obtained from tests conducted by the National Bureau of Standards (NBS) and by the International Energy Agency (IEA) with the results of the theoretical analysis shows that the observed scatter of data is primarily caused by systematic errors when conducting the test. However, the scatter is also caused by production-dependent changes of the collector properties and by the fact that ambient conditions were not sufficiently considered. The analysis of the test methods by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and by the Bundesverband fuer Solarenergie (BSE) showed that the BSE standard yields better results - particularly for the climatic conditions in Central Europe - than the ASHRAE standard. A simple correction of the systematic deviations observed in BSE tests, causec by the fact that the temperature of the absorber is lower than of the transfer fluid, is suggested. Author (ESA)

N80-26880# Open Univ., Milton (England). Energy Research Group.
A CHEMICAL HEAT-PUMP/ENERGY STORAGE DEVICE AND ITS APPLICATIONS
Sep. 1978 78 p refs Prepared jointly with Rutherford High Energy Lab., Chilton, England
(Grant SRC-G/RA/53604)
(ERG-030) Avail: NTIS HC A05/MF A01; Secr. Energy Res. Group, Milton Keynes, England

A prototype heat-pump was constructed and operated, using sulfuric acid and water as the chemical pair. It achieved a power output of 3.5 kW (this with malfunctioning heat exchangers). The heat-pump chemicals can be reconcentrated either using heat (greater than 120 C) or electricity; in the latter case the chemicals store heat-pumping capacity (with a COP of about 1.5). Thus the chemical heat-pump may find application in conjunction with either waste-heat or off-peak electricity (from nuclear, wind or wave devices at any time other than peak demand time). On the basis of present cost-assumptions, the chemical heat-pump may be immediately cost-effective: using waste heat to provide industrial process heat, using waste heat to provide space-heating and cooling, and as an off-peak heat-pump (reconcentration by electricity). Industrial heat demand in the dairy, bottle washing and brewing industries was analyzed. Author (ESA)

N80-26881# American Association for the Advancement of Science, Washington, D.C. Office of Public Sector Programs.
ENERGY AND RESOURCE RECOVERY FROM SOLID WASTE: REPORT FROM A WORKSHOP CONSIDERING PROBLEMS IDENTIFIED BY THE INTERGOVERNMENTAL SCIENCE, ENGINEERING, AND TECHNOLOGY ADVISORY PANEL
1979 237 p refs Conf. held in Lanham, Md., 24-26 Sep. 1979
(Grant NSF OPA-78-24464)
(PB80-150790; AAAS/PUB-79/R/17; NSF/RA-790345) Avail: NTIS HC A11/MF A01 CSCL 13B

Problem areas considered by a workshop on energy and resource recovery from solid waste include: institutional and economic issues; environment and health issues; production technology issues; and use technology issues. Separate working groups, set up to consider each of these issues, prepared draft reports which make up the separate sections of this report.GRA

N80-26882# Illinois Inst. of Natural Resources, Springfield.
ILLINOIS STATE PLAN: ENERGY CONSERVATION IN INSTITUTIONS (INSTITUTIONAL BUILDINGS GRANT PROGRAM)
Steven K. Thomas, Steven L. Tuma, and John Shum 15 Aug. 1979 96 p Prepared in cooperation with Contract Research Corp., Chicago
(PB80-148182) Avail: NTIS HC A05/MF A01 CSCL 10A

The Illinois state plan for the Institutional Buildings Grant Program is presented. The plan addresses very narrow legislative requirements of the Energy Conservation Policy Act. The plan illustrates the strategies and commitments to achieve full implementation of the Energy Grant Program in Illinois. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-26883*# Research Triangle Inst., Research Triangle Park, N. C.
THE 1979 SOUTHEASTERN VIRGINIA URBAN PLUME STUDY (SEV-UPS): SURFACE AND AIRBORNE STUDIES
J. H. White, W. C. Eaton, M. L. Saeger, R. B. Strong, and J. B. Tommerdahl May 1980 239 p refs
(Contract NAS1-15827)
(NASA-CR-159233; RTI/1816/01-F) Avail: NTIS HC A11/MF A01 CSCL 13B

The operation of two surface monitoring stations (one in downtown Norfolk, Virginia, one south of the city near the Great Dismal Swamp) and the collection of 40 hours of airborne measurements is described. Surface site measurements of ozone, oxides of nitrogen, sulfur dioxide, temperature, dew point, b sub seat, and condensation nuclei were made. Instrument calibrations, quality assurance audits, and preliminary data analysis in support of the Urban Plume Study were also made. The air pollution problems that were addressed are discussed. Data handling procedures followed for the surface stations are presented. The operation of the aircraft sampling platform is described. Aircraft sampling procedures are discussed. A preliminary descriptive analysis of the aircraft data is given along with data or plots for surface sites, airborne studies, hydrocarbon species, and instrument performance audits. Several of the aircraft flights clearly show the presence of an urban ozone plume downwind of Norfolk in the direction of the mean wind flow. J.M.S.

N80-26884# National Research Inst. for Oceanology, Stellenbosch (South Africa). Coastal Engineering and Hydraulics Div.

BEACH SEDIMENT SAMPLING METHODS

L. Lenhoff Aug. 1979 75 p refs

(CSIR-RR-366; ISBN-0-7988-1561-2) Avail: NTIS HC A04/MF A01

The sampling of beach sediments can be done in numerous ways and in many instances a choice of sampling method is made without considering the degree of accuracy which can be expected. Since the median grain diameter is a critical factor in many coastal engineering problems, the accurate determination of this parameter is of great importance. A standard sampling lay-out for the foreshore part of a beach profile is necessary in order to obtain a reliable estimate of the mean median grain diameter for coastal engineering application. Experiments were done on six test beaches which were selected on the basis of their different sediment characteristics. The results of different sample combinations were statistically analysed in order to determine the number of samples which is necessary to obtain a reliable estimate of the grain size within a given confidence band. The most significant conclusion which can be drawn is the recognition of two distinct grain size populations which are separated by the mid-tide line. A minimum of five samples is needed from each zone to obtain an acceptable estimate of the mean value of the median grain size. All the samples from the same zone may be combined into one composite sample to simplify the analysis. This implies that only two samples are obtained for each beach section, namely, one for the upper and one for the lower foreshore. Some sampling techniques which can be applied to simplify the sampling procedure were also evaluated. A number of recommendations with regards to these techniques are given. Author

N80-26885*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUPPORTING STATEMENT FOR COMMUNITY STUDY OF HUMAN RESPONSE TO AIRCRAFT NOISE

Thomas K. Dempsey, Richard DeLoach, and David G. Stephens Mar. 1980 30 p

(NASA-TM-81803) Avail: NTIS HC A03/MF A01 CSCL 13B

A study plan for quantifying the relationship between human annoyance and the noise level of individual aircraft events is studied. The validity of various noise descriptors or noise metrics for quantifying aircraft noise levels are assessed. E.D.K.

N80-26886*# San Jose State Univ., Calif.

STRATOSPHERIC POLLUTANT TRANSPORTS BY PLANETARY WAVES AND TROPICAL CIRCULATIONS Final Report, Jul. 1979 - Mar. 1980

Christopher A. Riegel and Leonhard Pfister Mar. 1980 3 p (Contract NCC2-17)

(NASA-CR-163278) Avail: NTIS HC A02/MF A01 CSCL 13B

Radiosonde and U-2 aircraft data from the Intertropical Convergence Zone experiment of July, 1977 were analyzed. The radiosonde data above 15 km was plotted in the form of time-height sections so that wave motions in the meteorological variables (temperature, zonal wind, and meridional wind) could be easily delineated. The results showed the presence of a planetary 16 day Kelvin wave. More significantly, large amplitude gravity waves with vertical wavelengths on the order of 3-6 km were found. Spectral analysis of frequencies showed peaks in meridional wind variance at 2-3 days and 5 days, with the shorter periods stronger at higher altitudes. In the time domain, two instances of organized wave groups propagating upward into the stratosphere were isolated. Associated with one of these wave groups was a region of very large vertical shear in which either turbulence or small scale (10 km wavelength or less) gravity wave activity had been found by the U-2 aircraft. R.E.S.

N80-26887# Committee on Science and Technology (U. S. House).

IMPLEMENTATION OF THE CLIMATE ACT

Washington GPO 1979 234 p refs Hearing before the Subcomm. on Nat. Resources and Environ. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 40, 10 Jul. 1979 (GPO-52-471) Avail: Subcomm. on Natural Resources and Environment

A 5-year plan for assessing natural and man-induced climatic processes and their biological and socioeconomic implications and impacts is presented and examined. Tactics for basic research and for considering the variability of climate in planning national programs related to agriculture, energy, transportation, and water resources are stated along with methods for information dissemination by the twelve government agencies involved. A.R.H.

N80-26888# World Meteorological Organization, Geneva (Switzerland).

THE LONG-RANGE TRANSPORT OF POLLUTANTS AND ITS RELATION TO GENERAL CIRCULATION INCLUDING STRATOSPHERIC/TROPOSPHERIC EXCHANGE PROCESSES

1979 450 p refs Presented at WMO Symp., Sofia, 1-5 Oct. 1979

(WMO-538; ISBN-92-63-10538-3) Avail: NTIS HC A19/MF A01

The following topics are discussed: emissions of pollutants sustained in long range transport and dust occurrences; distribution of pollutants and dust transport in space and time; chemical transformations of pollutants during the long range transportation; removal processes and removal rates during the long range transportation; modeling and meteorology of long range transport of pollutants and dust including stratospheric tropospheric exchange processes; and scientific problems related to measurement of relevant pollutants and dust. For individual titles, see N80-26889 through N80-26942.

N80-26889# Norwegian Inst. for Air Research, Lillestrom.

EMISSION OF GASEOUS AND PARTICULATE MATTER IN RELATION TO LONG-RANGE TRANSPORT OF AIR POLLUTANTS

Arne Semb *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 12 p refs Sponsored in part by Norwegian Min. Council (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

The sources for preparing emission surveys for SO2 and NOx are discussed. These are based mainly on fossil fuel consumption data. Comparable estimates can also be made for reactive hydrocarbons, soot, lead, and vanadium. The data relate mainly to the OECD countries of Europe. Author (ESA)

N80-26890# Battelle Pacific Northwest Labs., Richland, Wash.

EMISSION SOURCE SPECIFICATION IN A REGIONAL POLLUTANT TRANSPORT MODEL

D. J. McNaughton *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 3-8 refs (For primary document see N80-26888 17-45)

(Contract EY-76-C-06-1830)

Avail: NTIS HC A19/MF A01

A series of sensitivity and verification tests are examined to evaluate various means of emission source specification in a regional model. The regional air quality model incorporates pollutant transport, dispersion, chemical transformation, dry deposition, and precipitation scavenging of primary and secondary pollutants. Specification of emissions sources in a regional model can be a difficult and time consuming activity where temporal and spatial resolution of predictions must be weighted against computational costs. In regional scale modeling, the resolution of this problem may lie in the relative contributions of initial input data to pollutant concentration patterns contrasted with other causal factors such as precipitation scavenging and other removal mechanisms. The effects of spatial averaging of emissions are discussed as would be applicable to models using gridded emissions as input. The analysis makes use of observed ambient air concentration data for sulfate and sulfur dioxide and sulfate concentrations in precipitation. Author (ESA)

N80-26891# Power Research Inst., Prague (Czechoslovakia).

SOME RESULTS OF AIRBORNE AIR POLLUTION MONI-

TORING FROM CROSS-SECTION FLIGHTS OVER CZECHOSLOVAKIA
M. Prokup *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 11-15 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

A series of 13 sampling flights were made between 50 and 2700 m altitude in clear weather, testing for SO2 and sulfates using Whatman 40 filters and barium perchlorate Thorin. The main sources of pollution are a concentration of lignite-fired thermal power stations. The effects of frontal activity and temperature inversions on sampling are discussed. Author (ESA)

N80-26892# National Inst. of Public Health, Bilthoven (Netherlands).
AERIAL DETERMINATION OF LONG RANGE TRANSPORT
T. Schneider *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 17-23 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Two series of sampling flights over the Netherlands are described: the first measuring the transport of air pollution over sea (from Great Britain), the second studying the interaction of ozone with other pollutants. Levels of SO2 were found to vary greatly with altitude. Air masses transported over land were found to contain less ozone than those arriving over the sea. The source of the ozone is open to question, but the concentrations correlate with plant damage data. Author (ESA)

N80-26893# Rhode Island Univ., Kingston. Graduate School of Oceanography.
LONG-RANGE TRANSPORT OF POLLUTION AEROSOL TO THE ARCTIC: A PROBLEM WITHOUT BORDERS
Kenneth A. Rahn and Richard J. McCaffrey *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 25-35 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Large amounts of aerosol are found in the Arctic atmosphere during winter. Constituents such as V, Mn, sulfate, and Pb210 increase by factors of 10 to 30 from summer to winter and cause the Arctic haze. The bulk of the aerosol is thought to be aged, secondary in nature, and pollution-derived. The dominant source is probably Eurasia. Author (ESA)

N80-26894# Risoe National Lab., Roskilde (Denmark). Danish Air Pollution Lab.
REGIONAL SOURCE QUANTIFICATION MODEL FOR SULFUR OXIDES IN EUROPE
L. P. Prahm, K. Conradsen (Tech. Univ. of Denmark, Lyngby), L. B. Nielsen (Tech. Univ. of Denmark, Lyngby), and A. Eliassen (Norwegian Meteorol. Inst.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 37-44 refs Sponsored by Scandinavian Council of Ministers (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Location and emission strength of sulfur oxide sources in Europe are estimated by a meteorological air quality model based on air quality measurements and air trajectories. The data base used consists of 24 hour SO2 and SO4 measurements from 45 stations in Europe during the period from 1973 to 1975, and of air trajectories arriving 4 times a day at each station. A large number of linear equations are produced estimating SO2 and SO4 values with emission fields as unknowns. Relating the measured and estimated SO2 and SO4 values to each other by a least square method gives an estimate of the emission fields. Agreement between the calculated estimate and the model result was found for most of the emission areas. The emission in some European areas, however, was found to be both overestimated and underestimated. Possible reasons for this disagreement are discussed. The regional source quantification model is demonstrated to be useful for source estimation on a regional scale. Author (ESA)

N80-26895# Hydrometeorological Inst. (Czechoslovakia).
SULFUR COMPOUNDS IN BACKGROUND AIR-POLLUTION IN CZECHOSLOVAKIA
Santroch Jaroslav and Zavodsky Dusan *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 45-51 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Site descriptions and operating criteria are given for two background stations co-located with regular meteorological stations. Monthly mean concentrations of sulfur oxides, annual weighted averages of pH, conductivity and concentrations of all basic components in precipitation and other data are shown for 1978. Average concentrations of SO2 and particulate sulfates for air trajectories are plotted. Author (ESA)

N80-26896# Finnish Meteorological Inst., Helsinki.
ON THE CONTRIBUTION OF METEOROLOGICAL FACTORS TO THE SEASONAL VARIATIONS IN ATMOSPHERIC SULFUR CONCENTRATIONS
Goeran Nordlund *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 53-63 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

High concentrations of SO2 at ground level in rural Finland were found to occur in a few winter months in a way which could not be explained by the seasonal differences in emission values. Meteorological data from Jokioinen were analyzed, including wind speed and direction, calculated mixing depth and precipitation frequencies, amounts, and rates. It is concluded that the seasonal variations in the mean mixing depth and the occurrence of surface inversions has a decisive influence on the variations in ground level sulfur concentrations due to long distance transport. Author (ESA)

N80-26897# Environmental Research and Technology, Inc., Westlake Village, Calif.
ASSESSMENT OF REGIONAL AIR POLLUTION OVER THE EASTERN UNITED STATES. RESULTS FROM THE SULFATE REGIONAL EXPERIMENT (SURE)
G. M. Hidy, P. K. Mueller, T. F. Lavery, and K. K. Warren *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 65-76 refs Sponsored by Electric Power Research Inst. (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The results of the SURE program have provided insight into the behavior of sulfur oxides on a regional scale over the eastern United States. During the study period of 1977-1978, there was definite evidence of widespread accumulation of particulate sulfate concentrations centered in the Ohio Valley and western Pennsylvania near a zone of high SO2 emission density. Nitrate levels displayed a geographical distribution differing from sulfate, with concentrations at the ground lower than sulfate. Nitrate was the more prevalent along the Great Lakes and on the East coast compared with sulfate maximum in the rural areas of the Midwest. Sulfate concentrations were found to be maximum in summer with minimal sulfur dioxide, but sulfate also was high in concentration with high sulfur dioxide in winter. Nitrate displayed a strong maximum in winter with a seasonal nitrogen oxide concentration maximum. The regional elevations of sulfate were episodic in nature, with a duration of 2-5 days. Two kinds of regional scale events were observed, the first associated with broad air mass stagnation around the southern parts of a high pressure over high SO2 emission areas. The second was found in a southwesterly directed, ducted flow of polluted air extending over distances exceeding a 1,000 km, between frontal disturbances and a mountainous topography. The latter appears to have a character identifiable with long range transport of pollution.
Author (ESA)

N80-26898# Institute of Applied Geophysics, Moscow (USSR).
THE PRINCIPLE OF SITING CONTROL STATIONS IN LONG RANGE TRANSPORT OF AIR POLLUTANTS
B. N. Bronin *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 79-84 refs

(For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

An algorithm was written for identifying pollution sources given a discrete concentration field, the wind field, and a model of long range pollution transport. A second algorithm was developed for optimally siting a limited number of monitoring stations, using as input the information calculated in the first algorithm. Author (ESA)

N80-26899# Teknekron, Inc., Waltham, Mass. Energy and Environmental Systems Div.

CHARACTERIZATION OF REGIONAL EPISODES OF PARTICULATE SULFATES AND OZONE OVER THE EASTERN UNITED STATES AND CANADA

Eugene Y. Tong, Michael T. Mills, Brand L. Niemann, and Lowell Smith (EPA, Washington, D.C.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 85-93 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Compilation of existing aerometric data for the eastern United States and Canada has enabled a synoptic regional analysis to be made of air pollution episodes due to the occurrence of particulate sulfates and ozone. Analysis of the air quality and meteorological data bases on both the regional and local scales has provided the delineation of those meteorological patterns that are most conductive to the onset, peaking, and decline of particulate sulfates and ozone. It was found that there is strong evidence in support of the co-occurrence of elevated concentrations of atmospheric sulfates and ground-level ozone over the industrialized eastern United States and Canada. These warm episodes are not only related to the trajectories of the polluted air parcels, but also to certain easily identifiable synoptic features on the daily weather maps. The most outstanding sulfate/oxidant episodic situation is related to a generally eastward moving (over the Great Lakes) occluded frontal system and the circulation around the Bermuda High. The presence of a southeastward moving cold front often enhances the channeling effects for long distance transport. The manifestation of these regional episodes can often be spatial scales of several hundred miles or more. There is also evidence that precipitation over the haze layer removes suspended sulfates which in turn decrease the pH of the rain water. Author (ESA)

N80-26900# Atomic Energy Research Establishment, Harwell (England). Environmental and Medical Sciences Div.

DRY DEPOSITION OF GASEOUS POLLUTANTS

J. A. Garland *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 95-103 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The dry deposition process is defined and methods of measurement with the advantages and disadvantages of each are presented. Deposition velocities for gases to land surfaces and uptake by the sea are described. It is concluded that while dry deposition for ozone and sulfur dioxide are well documented, information on most other gases of interest is incomplete. Author (ESA)

N80-26901# Institute of Applied Geophysics, Moscow (USSR).

SNOW COVER AS AN INDICATOR OF A LONG-RANGE POLLUTANT TRANSPORT IN THE MONITORING SYSTEM

T. N. Jygalovskaya, I. M. Nazarov, O. S. Renne, and S. D. Fridman *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 105-108 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

An area 2000 km long having a low natural background of pollutants, and located downwind of an industrial complex was studied. Concentrations of Ni, Pb, Zn, Cu, V, Ti, Ag, and Co were measured in snow samples at the time of standard determination of snow water content. Pollutants were detected at distances greater than 1000 km. Author (ESA)

N80-26902# Institute of Applied Geophysics, Moscow (USSR).

PETROLEUM HYDROCARBON ATMOSPHERIC TRANSPORT

V. P. Andryukov and I. M. Nazarov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 109-115 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The physical properties and chemical composition of samples of organic aerosols taken near an industrial complex and in background regions in the Soviet Union were studied to determine their removal rates and to assess the proportion of petroleum hydrocarbons in the total. Samples were taken on glass fiber filters, extracted with carbon tetrachlorine and analyzed chromatographically. It was found that: (1) organic aerosols in the continental atmosphere mainly contain petroleum hydrocarbons with molecules that consist of 12 and more atoms of carbon; (2) aerosols, containing petroleum hydrocarbons, have a diameter less than 0.2 micrometer; (3) to define anthropogenic hydrocarbons in the marine atmosphere it is necessary to sample aerosols with a diameter less than 0.2 micrometer; and (4) in the atmospheric transport of petroleum hydrocarbons, paraffin hydrocarbons are subjected to the most rapid chemical destruction. Author (ESA)

N80-26903# Institute of Applied Geophysics, Moscow (USSR).

INVESTIGATION OF PARAMETERS OF DILUTION AND REMOVAL OF SULFUR DIOXIDE AND LEAD DURING TRANSPORT ABOVE THE OCEAN

S. M. Korolev and A. G. Ryaboshapko *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 117-124 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Long range lead and SO2 transport from industrial complexes situated on the coast to 1000 km over the ocean are examined to determine dilution and removal parameters. Measurements were made near the sea surface. Atom absorption was used to determine lead content, the West-Gaeke method for SO2, and lead 214 concentration by gamma spectrometry methods. Reverse trajectories of air mass were drawn for each sample to determine transport time. Curves are presented for pollutant concentrations as a function of transport time, and for concentrations at various distances from the coast. Author (ESA)

N80-26904# Norwegian Inst. for Air Research, Lillestrom.

LONG RANGE TRANSPORT OF AIR POLLUTANTS WHICH ARE RE-EMITTED TO THE ATMOSPHERE

Brynjulf Ottar *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 125-125k refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The re-emission of some air pollutants having a high vapor pressure in the solid state to the atmosphere is discussed. Information collected on the emission, dispersion, and deposition of mercury and polychlorinated hydrocarbons shows that re-emission of previously deposited amounts plays an important part in the long range transport of these substances. Because the re-emission depends on temperature and seasonal climatic variations, as well as the vapor pressure and other chemical characteristics of the specific components, the establishment of the large scale dispersion pattern must be a slow process. In the case of mercury the natural emissions dominate on a global scale. The man-made emissions may only modify this pattern on a local or regional scale. The more important abatement efforts for mercury pollution in air and water will therefore be of a local character. Measurements indicate that the mercury concentration in the topsoil is enhanced at higher latitudes in the northern hemisphere, because of a systematic transfer of mercury from warmer areas. A similar development has been suggested for the polychlorinated hydrocarbons. Author (ESA)

N80-26906# Institute of Applied Geophysics, Moscow (USSR).

ATMOSPHERIC TRANSPORT OF ORGANOCHLORINE PESTICIDES

V. M. Koropalov and I. M. Nazarov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 127-132 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

Aircraft sampling of pesticide distribution in the atmospheric boundary layer was conducted over a region in Central Asia. Vertical profiles of pesticide and atmospheric aerosol indicate that most of the pesticide enters the atmosphere as vapor, that sorption of the pesticide on atmospheric aerosol occurs in the atmosphere, and pesticide removal is largely determined by the removal rate of the aerosol fraction. Author (ESA)

N80-26906# Institute for Hydrology and Meteorology, Sofia (Bulgaria).

FLUCTUATIONS OF THE ABUNDANCE OF CARBON MONOXIDE

S. Bodanov, P. Videnov, and E. Savov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 135-139 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

Spectroscopically determined abundances of CO from an urban area and from rural background locations were compared in an attempt to relate background amounts to the change in the air mass over the region. Measurements for several days in the same air mass gave equal background abundances, and varied with the change of the air mass. It is concluded that variations in background abundance in periods on the order of one month are related to the origin and trajectories of the air masses. Author (ESA)

N80-26907# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.

MECHANISMS AND RATES OF FORMATION OF SULFUR AEROSOLS IN POWER PLANT PLUMES

R. F. Pueschel and Y. Mamane (Technion - Israel Inst. of Tech.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 141-148 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

Aerosol size distributions, aerosol elemental composition, and the concentrations of fine particles and trace gases at three typical locales in order to explore the potential effects on the environment of coal-fired power plant operations. The three cases are the plume proper of a 2150 megawatt power plant burning low sulfur coal, the atmosphere outside but close to the plume, and the atmosphere of a region hundreds of miles away from any industrial operation. The aerosol dynamics, discussed in terms of the lumped mode heterodisperse coagulation model show that the formation rates of condensation nuclei are similar for the power plant plume and the rural atmosphere. However, the rural aerosol is of natural origin and is dominated by organic particles, whereas the plume aerosol consists of siliceous spheres mixed with sulfate particles. The aerosol dynamics further show that the accumulation mode at around 0.1 micron radius is the most persistent feature of the atmospheric aerosol with turnover times of weeks to months. The particle concentration and modal radius of this mode is larger in the plume and its immediate vicinity than it is in the rural atmosphere. The data also show a significant increase in aerosol concentration in the plume at the coarse particle mode of radii larger than 1 micron. However, rapid settling of these relatively large particles results in turnover times of only hours. M.G.

N80-26908# Atomic Energy Research Establishment, Harwell (England). Environmental and Medical Sciences Div.

SOME ASPECTS OF THE FORMATION, TRANSPORT AND DESTRUCTION OF PHOTOCHEMICAL OXIDANTS IN NORTH-WEST EUROPE

R. G. Derwent *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 149-156 refs Sponsored by UK Dept. of Environ. (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

The time scales for formation and decay of the photochemical air pollutants (ozone, peroxyacetylnitrate (PAN), sulfates, and nitrates) are reviewed. A two step reaction model was developed for secondary pollutant formation, and is used to calculate typical behavior of secondary pollutants in southeast England. Author (ESA)

N80-26909# Environmental Protection Agency, Research Triangle Park, N.C. Regional Field Studies Office.

TRANSFORMATION DURING TRANSPORT: A STATE-OF-THE-ART SURVEY OF THE CONVERSION OF SO2 TO SULFATE

William E. Wilson and Noor V. Gillani (Washington Univ., St. Louis) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 157-164 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

The parameters influencing the conversion rate of SO2 to sulfate are examined. A conceptual model of the various stages in the physical and chemical life history of a power plant plume is constructed and used to examine and interpret the influence of parameters such as mixing, solar radiation, and background air reactivity on reaction rates. Experimental evidence for various aspects of the model from field measurements and smog chamber studies is described. M.G.

N80-26910# Stockholm Univ. (Sweden). Dept. of Meteorology.

FORMATION OF SULFURIC AND NITRIC ACID IN THE ATMOSPHERE DURING LONG RANGE TRANSPORT

H. Rodhe, P. Crutzen (Natl. Center for Atmospheric Res.), and A. Vanderpol (Meteorol. Res., Inc.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 165-171 refs (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

A simple chemical model describing the basic transformation of sulfur and nitrogen oxides to the corresponding acid is presented and combined with a model for transport and deposition over time scales of a few days. Formation of HNO3 in the model takes place faster than that of H2SO4, agreeing with observations. An increase in the emission rate of hydrocarbons is found to enhance the rate of acid production. Changes in the emission of NOx may similarly affect the formation of both sulfuric acid and nitric acid. A proportional dependence of concentrations on emission rates may not be assumed in coupled chemical systems; demonstrated by the model results showing that increased acid concentrations in the air is much less than the increase in the emission rates of NOx and SO2. M.G.

N80-26911# Atomic Energy Research Establishment, Harwell (England). Environmental and Medical Sciences Div.

GENERATION OF SECONDARY POLLUTANTS IN THE ATMOSPHERIC BOUNDARY LAYER IN A HIGH PRESSURE SITUATION

Oeystein Hov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 173-180 refs Sponsored by Royal Norwegian Res. Council for Sci. and Technol. and UK Dept. of Environ. (For primary document see N80-26888 17-45)

Avail: NTIS HC A19/MF A01

An atmospheric model was used to investigate theoretically the potential for oxidant formation from UK emissions of hydrocarbons, nitrogen oxides and sulfur dioxide, and evaluate the potential for long range transport of species generated from UK emissions during anticyclonic weather. NO, SO2, CO, and various hydrocarbons are emitted into the model volume, in all, 40 species. The emissions of the various species are split into eight source categories. The chemical formulation of the model includes approximately 145 intermediate and end products, in addition to the 40 emitted species. About 300 reactions are required to describe the degradation pathways. Model generated species are compared with measurements from the literature. Data for ozone and sulfate show good agreement. Smog formation mechanisms are shown to be different for intense urban smog where the time scale is short and on a multiday scale. Author (ESA)

N80-26912# Swedish Water and Air Pollution Research Lab., Goeteborg.

INTERACTION OF GASES WITH SULFURIC ACID AEROBOL IN THE ATMOSPHERE

Ying-Hua Lee and Cyrill Brosset *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 181-192 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The interactions of sulfuric acid dorplets with gaseous components in the ambient air are examined. Calculations are carried out for the systems H2SO4-H2O-NH3 and H2SO4-H2O-NH3-HNO3-HCL, in the form of fine droplets (nucleation mode). The composition of the solutions at the respective points in mole/kg solution of (NH4)2SO4 and H2SO4 is given. Ion composition is calculated as well as the molar ratios (NH4+):(H+) -O. Composition of the liquid phase is presented in terms of ratios of total concentration of NH4+ and SO4 with relative humidity and partial pressures of NH3, HNO3 and HCL. Concentration of nitrate and chloride in solution amounts to 0.1 and 0.05, respectively of total sulfate. Author (ESA)

N80-26913# National Pollution Control Commission, Manila (Philippines).

A COMPARISON BETWEEN TWO METHODS OF MEASURING THE CONCENTRATION OF SUSPENDED PARTICULATES

Guillermo A. Pecache *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 193-197 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

A high volume sampler which determines particulate concentration by a gravimetric method, and a light scattering sampler are compared. Analysis of the daily average suspended particulate concentration data shows that there exists a significant relationship between the 24 hour average particulate concentrations as measured by both instruments. The relationship obtained for the data is expressed in terms of the linear equation Y = 7 + 2.5 X which given the value of the concentration determined by the high volume sampler as a function of the concentration recorded by the light scattering instrument. Since the tests of significance indicated that the intercept is not different from zero, it can be said further that the concentrations are simply directly proportional to each other; which consequently leads to the generalization that multiplying the light scattering instrument reading by 2.5 would be a fairly good way of obtaining the corresponding probable value that would result from a high volume sampler. Author (ESA)

N80-26914# Swedish Water and Air Pollution Research Lab., Goeteborg.

OXIDIZED NITROGEN COMPOUNDS IN LONG RANGE TRANSPORTED AIR MASSES

Peringe Grennfelt *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 199-208 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Measurements of oxidized nitrogen compounds made at a remote station (Roervik) on the Swedish west coast are examined. Wind trajectories were determined for isolated episodes of high concentration, and nitrogen mass balances determined. It is concluded that: in Europe, nitrogen oxides are transported over large distances in the same manner as sulfur oxides; practically no nitrogen monoxide remains in a long range transported air mass (for winter situations also); most of the nitrogen compounds remain in gas phase during transport, and only a minor fraction is found on particle filters; the dominant oxidized nitrogen compound in a long range transported air mass is usually NO2. Only a minor fraction of atmospheric nitrates will be found on particles, and the total solar concentration of oxidized nitrogen compounds exceeds the total concentration of oxidized sulfur compounds in long range transported air masses. Author (ESA)

N80-26915# Argonne National Lab., Ill. Chemical Engineering Div.

USE OF OXYGEN ISOTOPY IN THE STUDY OF TRANSFORMATIONS OF SO2 TO SULFATES IN THE ATMOSPHERE

Ben D. Holt, Paul T. Cunningham, and R. Kumar *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 207-212 refs Sponsored by DOE (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Atmospheric sulfate formation is analyzed using oxygen isotopy. Sequential seven day samples of water vapor, particulate sulfate and sulfur dioxide were continuously collected throughout the four seasons. Samples of rain and snow were also collected for most of the precipitation events during this period. The isotopic results obtained from the sampling program were plotted versus time. The data are given in units of delta o18, which is the deviation in parts per thousand of the o18/o16 ratio of the sample from that of Standard Mean Ocean Water. The curves for atmospheric water vapor and precipitation are similar, while curves for sulfate in precipitation show the influence of the precipitation water on the delta o18 of the dissolved sulfate, as well as a seasonal variation. Aerosol sulfate shows no distinct seasonal variation, unlike particulate sulfates collected on inert filters at the same site. Various explanations are presented for this phenomenon. Author (ESA)

N80-26916# Atmospheric Environment Service, Downsview (Ontario).

AN ATMOSPHERIC SULFUR BUDGET FOR EASTERN NORTH AMERICA

Douglas M. Whelpdale and James N. Galloway (Virginia Univ.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 213-221 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

An atmospheric sulfur budget for eastern North America is constucted. The input terms considered are man-made emissions, natural emissions, and flows from outside the region; the outputs considered are wet deposition, dry deposition, and outflows across the boundaries of the region. Estimates of the budget terms are made separately for Canada and the U.S., then combined to produce a budget for the region as a whole, using recent data. From independent best estimates of budget terms a reasonable balance is found between inputs and outputs of sulfur in the atmosphere of eastern North America. The inputs and outputs which are dominant in the biogeochemical sulfure cycle of the region are man-made emissions, wet and dry deposition, and outflow to the oceans. Major uncertainties exist in the magnitudes of the biogenic emission terms, but these inputs are small relative to other inputs. Of the approximately 18 Tg S y entering the region s atmosphere, some 57% of it is deposited back to the surface of the region as a result of wet and dry deposition. The remainder leaves the region by atmospheric transport, primarily to the east. Author (ESA)

N80-26917# Institute of Meteorology and Water Management, Warsaw (Poland).

AN ASSESSMENT OF WET REMOVAL OF SULFUR FROM AIR BY RAINFALL IN POLAND

Regina A. Hryniewicz *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 223-229 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Concentrations of sulfur compounds taken from precipitation samples in Poland are used to calculate the empirical efficiency coefficients of wet sulfur removal. The coefficients are defined as a ratio of the amount of sulfur removed from 1 cu mm of air by 1 mm of precipitate, to the concentration of sulfur in the air. A constant rate for wet sulfur removal is obtained by multiplying the efficiency coefficient by the real or assumed rain rate. Coefficients for winter months varied from 0.164 mm to 0.103 mm, and are 2.3 times greater for the remaining months. Comparisons with other European stations indicate that differing climate conditions have an effect on the values of the calculated parameters, and that efficiency coefficients have lower values for areas having higher pollution levels. Author (ESA)

N80-26918# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.

THE ACIDITY OF HAWAIIAN PRECIPITATION AS EVI-

DENCE OF LONG-RANGE TRANSPORT OF POLLUTANTS
John A. Miller *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 231-237 refs (For primary document see N80-26888 17-45)
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Precipitation samples were collected at five sites on the island of Hawaii from sea level to 3400 m for a period of four years. Samples were taken on a daily or biweekly basis and analyzed for pH, conductivity, and certain ions such as sulfate and nitrate were analyzed. The data show that the most acidic rains fall above the 2500 m level. Since the precipitation forming clouds must scavenge material above this level, it is suggested that acid forming pollutants reach mid troposphere levels and are transported long distances until being scavenged in the Hawaiian rains. Further analysis showed that the acidity measured at the 3400 m level is significantly higher when trajectories come from a northerly direction than from a southerly direction, perhaps reflecting differences in hemisphere sources.
Author (ESA)

N80-26919# Meteorological Office, Bracknell (England). Boundary Layer Research Branch.
THE CHARACTER AND IMPORTANCE OF PLUME LATERAL SPREAD AFFECTING THE CONCENTRATION DOWNWIND OF ISOLATED SOURCES OF HAZARDOUS AIRBORNE MATERIAL
F. B. Smith *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 241-251 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Lateral spread at short range is discussed to show that various statistical methods exist which are effective and allow for distance and travel time, with or without consideration for wind shear. It is shown that at a somewhat longer range (100 km) mesocale turbulence is significant. At longer distances synoptic features are totally dominant and have an influence on lateral spread.
Author (ESA)

N80-26920# Bulgarian Academy of Science, Sofia. Inst. for Hydrology and Meteorology.
PRESSURE AND TOPOGRAPHY EFFECTS ON LONG-RANGE AIR POLLUTANTS TRANSPORT
G. D. Djolov and D. E. Syrakov (Sofia Univ.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 253-258 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

A long range air pollution transport model was developed, which treats regions on the scale of 2000 km in 50 km horizontal steps. The pollutant cloud was assumed to be transported by an external wind having constant velocity components in the cloud area. Topography and turbulent friction were parameterized through the field of the generated vertical motions. Results of numerical experiments are given, which show in particular that small values for vertical velocities on the order of a few cm/sec can cause large changes in the ground level concentration field.
Author (ESA)

N80-26921# Atmospheric Environment Service, Downsview (Ontario).
A NUMERICAL EXPERIMENT IN TRAJECTORY OF AIR POLLUTANTS OVER THE GREAT LAKES REGION
S. M. Daggupaty, P. I. Misra (Ontario Min. of Environ.), and R. E. Munn (Inst. of Environ. Studies) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 259-264 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

A numerical scheme was developed which incorporates the effects of variable acceleration in air parcels. Trajectories based upon the Pettersen numerical iterative scheme show discrepancies under light variable wind conditions, and near singular points associated with anticyclonic, cyclonic, and deformation zones. Acceleration in the described model was evaluated as a residue of the balance between pressure, coriolis and frictional forces. Calculations of the trajectory end points obtained by the new and by the old methods in a case study of a winter storm, differ by an average of 160 km at the end of 24 hr.
Author (ESA)

N80-26922# Institute of Meteorology and Water Management, Warsaw (Poland).
SENSITIVITY OF UNI-LEVEL TRAJECTORY MODEL TO RANDOM ERRORS IN INITIAL FIELDS
J. Bartnicki, J. Pruchnicki, and J. Pudy-Kiewicz *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 265-270 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The effects of errors involving initial conditions in trajectory models were studied by randomly disturbed wind and emission fields. The effect on concentration fields of SO2 and SO4 was observed. Chemical transformations were determined using mass balance equations. Errors were found to be much greater in the case of disturbances in the wind field as opposed to the emission field. The maximal model error was 50-60% for SO2 concentration, and 60-70% for SO4.
Author (ESA)

N80-26923# Institute of Applied Geophysics, Moscow (USSR).
A MODEL FOR OPERATIVE EVALUATION OF TRANSBOUNDARY FLOWS OF POLLUTANTS (SULFUR DIOXIDE AND SULFATES)
Y. A. Izrael, J. E. Mikhailova, and A. J. Pressman *In its* The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 271-279 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The model incorporates both dry deposition and precipitation washout processes, and permits calculation of SO2 mass reduction occurring through chemical transformations. It is possible also to estimate the concentration field produced by multiple sources, and to identify that fraction of pollutants imported from external sources.
Author (ESA)

N80-26924# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
METEOROLOGICAL DATA AND THE MESOS MODEL FOR THE LONG-RANGE TRANSPORT OF ATMOSPHERIC POLLUTANTS
J. Wrigley, H. M. ApSimon, and A. J. H. Goddard *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 281-287 refs (For primary document see N80-26888 17-45)
(Contract BC1687)
Avail: NTIS HC A19/MF A01

The most important parameters affecting the transport of pollutants, over distances of order 1000 km, are considered. These include: the effective wind speed and direction to determine trajectories; the state of the boundary layer in terms of changing mixing layer depth; stability and atmospheric turbulence; and depletion processes such as washout in rain. These parameters are used in the MESOS model to study the possible consequences of accidental releases of radioactivity and exposure from routine continuous releases from sites within Europe. The development of the data base providing all the relevant meteorological data across Europe, at 3-hourly intervals over a year, is described. Examples of the use of the data base with the MESOS model are given to illustrate the importance of accounting for spatial and temporal variation of meteorological data.
R.C.T.

N80-26925# Hydrometeorological Centre of the USSR (Moscow).
A MODEL FOR EVALUATION OF TRANSBOUNDARY SULPHUR DIOXIDE FLUX WITH THE INCLUSION OF VERTICAL MOTIONS
N. S. Veltischeva *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 289-295 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Improvements made to an existing three dimensional air

pollution transport model were examined. The number of computational levels in the lower 300 meters was increased, and a turbulence coefficient variable with height introduced. Model runs were made using actual SO2 concentrations as initial data. Comparisons with observed values were made which demonstrated the improved accuracy achieved when vertical motions were included. A model run was made which showed that the Western European contribution to SO2 in the Western U.S.S.R. is 6% to 7% of the total. Author (ESA)

N80-26926# Battelle Pacific Northwest Labs., Richland, Wash.
COMPARISON OF THE RESULTS OF AN EIGHT LAYER REGIONAL MODEL VERSUS A SINGLE LAYER REGIONAL MODEL FOR A SHORT TERM ASSESSMENT
W. E. Davis *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 297-304 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The results from an eight layer diabatic regional assessment model with estimates of vertical motions are compared to results from a single layer model without vertical motions for April 1974. Deposition results from the eight layer model with and without estimates of below cloud scavenging indicate that significant differences can occur in amounts deposited (in percent of total released), as well as in surface air concentrations of pollutants. Author (ESA)

N80-26927# Uppsala Univ. (Sweden). Dept. of Meteorology.
INITIAL DRY DEPOSITION AND TYPE OF SOURCE IN RELATION TO LONG DISTANCE TRANSPORT OF AIR POLLUTANTS
Ulf Hoesgstroem *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 305-306 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

A method for estimating the dry deposition loss in the immediate surroundings of a source was investigated, along with a sulfur budget for the Paris area. Budget data were based on air quality data from a station situated 37 km south of central Paris. A visual point source model is used, from which the wet and dry deposition loss were removed, along with an allocation loss factor. Author (ESA)

N80-26928# Sofia Univ. (Bulgaria). Dept. of Physics.
ON LAGRANGIAN CHARACTERISTICS OF TURBULENCE AND DIFFUSION IN THE PLANETARY BOUNDARY LAYER
Eugeni Syrakov and D. Yordanov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 307-314 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The joint influence of stratification, baroclinity, and wind rotation on the Lagrangian characteristics of turbulence and diffusion in the planetary boundary layer were investigated on the basis of similarity theory. A simple two layer model of a barotropic and neutrally stratified planetary boundary layer was considered. The Lagrangian trajectories are shown for different roughness parameters, and are in good agreement with experimental data. Results from Lagrangian trajectories are shown to be useful in determining some diffusion characteristics in the planetary boundary layer. Author (ESA)

N80-26929# Sofia Univ. (Bulgaria). Dept. of Physics.
ON THE GAUSSIAN AND NONGAUSSIAN MODELS OF TURBULENT DIFFUSION IN SYNOPTIC AND GLOBAL SCALES IN THE ATMOSPHERE
Eugeni Syrakov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 315-320 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

A semiempirical description of atmospheric turbulent diffusion is given. Diffusion coefficients are calculated for Gaussian and nonGaussian cases. The concentration distribution in the horizontal plane is computed and is shown to be, in most cases of a nonGaussian character. In the direction perpendicular to the wind, the concentration decreases more slowly than in the Gaussian case. Author (ESA)

N80-26930# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
LONG-RANGE MODEL OF SO2 AND SULFATE AND ITS APPLICATION TO THE EASTERN UNITED STATES
Teizi Henmi *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 321-328 refs (For primary document see N80-26888 17-45)
(Grant EPA-R-805271)
Avail: NTIS HC A19/MF A01

A model was developed which treats SO2 and sulfate transport and transformation in the daytime mixing layers, nighttime stable layer, and the layer between. A program that calculates the trajectories of plumes leaving from any chosen source area dispersion parameters, and the parameters necessary for concentration calculations along trajectory segments using observed wind data were included as well as a program that calculated the concentration of sulfur dioxide and sulfate along trajectory segments and interpolates the plume concentrations to grid intersections. The model was used to calculate the geographical distribution of 24 hour average concentrations of SO2 and sulfate over the Ohio River Basin. Input data included 60 sources of SO2 which constitute 90% of the total emissions over the area. Model output was compared with actual readings from background areas. Distribution patterns of calculated concentrations of both SO2 and sulfate were statistically related to those of the observed with correlation coefficients R = 0.550 and 0.487 respectively. Author (ESA)

N80-26931# Deutscher Wetterdienst, Offenbach am Main (West Germany).
ON THE EFFECT OF METEOROLOGICAL SIMPLIFICATIONS IN THE NUMERICAL SIMULATION OF REGIONAL TRANSPORT PROCESSES
Maria Heese, Ingo Jacobsen, Eberhard Mueller, and Juergen Pankrath (Fed. Environ. Agency, Berlin) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 329-336 refs Sponsored by Fed. Environ. Agency (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Numerical experiments were performed with a weather prediction model having a mesh size of 63.5 km, 6 layers below 2 km, and using a second order closure scheme. A full physics model run was compared with runs in which vertical transport of sulfur was added, changes in deposition velocities made, and advection added by 870 mbar winds. Variations in mean and dry deposition rates are shown for each model configuration with the passage of a low pressure area. Vertical profiles for the mixing ratios at the center of the surface depression show that a great part of the sulfur is transported to the upper layers. Author (ESA)

N80-26932# Teknekron, Inc., Berkeley, Calif. Aerometric Research Group.
APPLICATION OF A REGIONAL TRANSPORT MODEL TO THE SIMULATION OF OF MULTI-SCALE SULFATE EPISODES OVER THE EASTERN UNITED STATES AND CANADA
Brand L. Niemann, Allan A. Hirata, and Lowell F. Smith (EPA, Washington, D.C) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 337-346 refs (For primary document see N80-26888 17-45)
(Contract EPA-68-02-3092)
Avail: NTIS HC A19/MF A01

A pseudospectral technique for solution of regional transport equations was adapted to the problem of predicting multiscale sulfate episodes over the eastern United States and Canada. The initial evaluation of pseudospectral regional transport model was expanded to include the simulation of multiscale sulfate episodes under the three basic meteorological patterns that were found to be associated with regional and subregional scale sulfate episodes: strong persistent winds with quasistraight

trajectories: light variable winds with recirculating trajectories: and a combination of the first two in sequence or at the same time in different locations. The computational efficiency of the pseudospectral technique permitted extensive sensitivity analysis of the model predictions to the conversion and removal rates and comprehensive studies of the relative contributions from various pollutants (SO2 and primary sulfates), source categories and subregions to concentrations in other subregions. The agreement between model predictions and observations was generally very good for reasonable values of the conversion and removable rates. Author (ESA)

N80-26933# Oslo Univ. (Norway). Inst. of Geophysics.
TRANSPORT AND DISTRIBUTION OF POLLUTANTS IN THE TROPOSPHERE
Ivar S. A. Isaksen *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1978 p 347-358 refs Sponsored by Norwegian Res. Council for Sci. and the Humanities (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The chemistry of ozone and carbon monoxide formation and their tropospheric distribution were studied with a two dimensional time dependent model. The model covers all latitudes from the North Pole (-90 deg) to the South Pole (90 deg), with 10 deg (1100 km) distance between each gridpoint. In the vertical direction the model consists of 20 levels, with two different grid distances. Below 3.5 km delta Z=500 m, while above it is equal to 1 km. Marked differences in chemical activity with latitude and season are found. Calculated global distribution of carbon monoxide does not compare well with observations, which show a more uniform distribution with height in the Northern Hemisphere. Photochemical production of ozone is seen to have a noticable effect on the distribution in the Northern Hemisphere, where there is a net production of ozone at middle and low latitudes both during summer and winter months. It results in approximately 50% larger ozone densities in the lower troposphere in the Northern Hemisphere than what is obtained in the Southern Hemisphere. Outside the area which is influenced by man made sources, tropospheric chemistry is not found to favor any large ozone formation. Author (ESA)

N80-26934# Danish Meteorological Inst., Copenhagen.
GLOBAL TWO DIMENSIONAL SPECTRAL DISPERSION MODEL
Ruwim Berkowicz, Lars P. Prahm (Risoe Natl. Lab.), and Jean-Francois Louis (European Centre for Medium Range Weather Forecasts) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 359-365 refs (For primary document see N80-26888 17-45)
(Contract EEC-306-77-ENV-DK)
Avail: NTIS HC A19/MF A01

A diffusion model based on the spectral turbulent diffusivity theory (STD) is tested on dispersion of radioactive tracers in the atmosphere. A significant improvement is achieved compared with results obtained with the gradient-transfer formulation of diffusion. The STD theory makes it possible to treat atmospheric diffusion with a scale-dependent diffusivity, but in an Eulerian framework. Author (ESA)

N80-26935# Bulgarian Academy of Science, Sofia. Inst. of Geophysics.
INFLUENCE OF VERTICAL MOTIONS INDUCED BY THE FRICTIONAL CONVERGENCE IN PLANETARY BOUNDARY LAYER ON LONG RANGE POLLUTION
D. Yordanov, G. D. Djolov, and D. Syrakov (Sofia Univ.) *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 367-369 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The influence of the planetary boundary layer (PBL) on the long range transport of pollutants is investigated. An expression for the turbulent exchange coefficient is derived using the vertical velocity at the top of the PBL as a characteristic of the ordered vertical motions, considering adiabatic stratification and horizontal temperature homogenity. Rossby number and tabulated coefficients are used to express the former as a function of synoptic parameters. A numerical experiment is described giving the percentage change of surface concentration along the symmetry axis in graphical form. Author (ESA)

N80-26936# Sofia Univ. (Bulgaria). Dept. of Physics.
ON THE BASIC DEPENDENCIES OF THE RELATIVE EDDY DIFFUSION IN SYNOPTIC SCALES FOR ROTATING ATMOSPHERE
Eugeni Syrakov *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 371-376 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

The relative eddy diffusion of a pollution cloud is studied in a coordinate system having its base identical with its center of gravity. A statistical theory of turbulence is used wherein turbulence is viewed as a statistical ensemble of vortices having various scales. In the appropriate scales, rotational effects are treated by the introduction of dimensionless parameters. The relative diffusion coefficients are in qualitive agreement with observational data. Author (ESA)

N80-26937# National Center for Atmospheric Research, Boulder, Colo.
THE EXCHANGE OF CHEMICAL CONSTITUENTS BETWEEN THE STRATOSPHERE AND TROPOSPHERE THROUGH TURBULENT MIXING PROCESSES WITHIN TROPOPAUSE FOLDS
M. A. Shapiro *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 377-383 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Small scale turbulent mixing processes within the jet stream associated tropopause folds were studied as a mechanism for chemical exchange across the tropopause. By combining the turbulent motion sensing capability of the Sabreliner research aircraft with fast response ozone and condensation nuclei measurements, the turbulent vertical flux of stratospheric ozone and tropospheric condensation nuclei across the tropopause was evaluated. Analysis of the flight data show the characteristic downward intrusion of high ozone concentration air into the folded portion of the tropopause. The tropopause fold was filled with planetary boundary layer concentrations of condensation nuclei, which when taken together with the ozone data provide evidence for the coexistence of chemical trace constituents of both tropospheric and stratospheric origin within the region of tropopause folding. The observations suggest that tropopause folds are mixing regions whose chemical characteristics lie somewhere in between those of the troposphere and the stratosphere, and that turbulent mixing is of first order importance as a mechanism for stratospheric-tropospheric chemical exchange in the vicinity of tropopause folds. Author (ESA)

N80-26938# New York State Univ., Albany. Atmospheric Sciences Research Center.
CIRCUMPOLAR MEASUREMENTS OF OZONE, PARTICLES, AND CARBON MONOXIDE FROM THE 50TH ANNIVERSARY FLIGHT OF A PAN AMERICAN AIRLINER
R. Pratt and P. Falconer *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 385-392 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Beginning in San Francisco and then circling the globe over both poles before returning 54 hours later, this flight simultaneously sampled gases (ozone, carbon monoxide) and particles (condensation nuclei, light scattering fraction) around the world. High resolution measurements were taken of several constituents, with interruptions only for calibration. These data constitute a rather unique example of the simultaneous measurement of several trace constituents, in a variety of meteorological situations. Curves are given showing the distribution of all constituents averaged over one deg latitude intervals. Data are presented chronologically as segments from the North and South polar stratospheres, and from the tropical and subtropical troposphere of the Atlantic and Pacific hemispheres. Tropical ozone measurements indicate

that even within the tropics, the distribution of ozone is largely determined by quasi-horizontal, synoptic scale meteorological transport in the troposphere. Author (ESA)

N80-26939# Colorado State Univ., Fort Collins. Dept. of Atmospheric Sciences.
TROPOSPHERIC-STRATOSPHERIC TRANSPORT PROCESSES: INDICATIONS OF THEIR INTERANNUAL VARIABILITY
Elmar R. Reiter *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 393-400 refs (For primary document see N80-26888 17-45)
(Grants NSF ATM-78-17835; EPA-805271-02)
Avail: NTIS HC A19/MF A01

Evidence is presented of a considerable interannual variability in the tropospheric-stratospheric transport processes, involving the tropical branches of the Hadley cells of the two hemispheres. This variability should effect the injection of tropospheric trace substances into the stratosphere. The observed interannual variability of the global ozone distribution might have its cause in the variability of these injection processes. Stratosphere-tropospheric air mass exchange in the let-stream region also appears to be subject to an interannual variability. Author (ESA)

N80-26940# Wisconsin Univ. - Madison.
SYSTEMATIC STRATOSPHERIC-TROPOSPHERIC EXCHANGE THROUGH QUASI-HORIZONTAL TRANSPORT PROCESSES WITHIN ACTIVE BAROCLINIC WAVES
Donald R. Johnson *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 401-408 refs (For primary document see N80-26888 17-45)
(Grant NSF ATM-77-22976)
Avail: NTIS HC A19/MF A01

A mechanism is presented within the isentropic structure of active baroclinic waves that provides for systematic stratospheric-tropospheric exchange within latitudinal domains where geostrophic motion occurs. The role of the exchange within the isentropic zonally-averaged structure of the global circulation is outlined. Large scale quasi-horizontal transport was identified within active baroclinic waves that provides for a net poleward transport of mass whthin isentropic layers that are located in the troposphere and stratosphere. The balance requirements inferred from zonally-averaged isentropic coordinates and some preliminary results dictate that the net exchange within isentropic layers that link the polar stratosphere with the troposphere of the lower latitudes must be poleward. The net mass transport in the isentropic zonally-averaged circulation structure occurs through a systematic covariance between the mass and meridional velocity within the baroclinic wave structure. Author (ESA)

N80-26941# World Meteorological Organization, Geneva (Switzerland).
REPARTITION IN SPACE AND TIME OF DUST HAZE SOUTH OF THE SAHARA
J. Bertrand, A. Cerf, and J. L. Domergue *In its* The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 p 409-415 refs (For primary document see N80-26888 17-45)
Avail: NTIS HC A19/MF A01

Hourly visibility observations from 27 stations were compiled from 1970 to 1974 in West Africa. Using the number of hours or number of days with visibilities reduced by dust haze, the spatial and temporal distributions of dust haze south of the Sahara were estimated statistically. The importance of dust as an atmospheric phenomenon in this region is demonstrated by figures. Critical zones and seasonal variations linked to the Intertropical Front position appear clearly. A general increase of dust haze since 1970, related to a pluviometric deficit in Sahelian zones, was noted. Author (ESA)

N80-26942# Washington Univ., St. Louis, Mo. Center for Air Pollution Impact and Trend Analysis.
SYNOPTIC-SCALE DISTRIBUTION OF MAN-MADE AEROSOLS
R. B. Husar and D. E. Patterson *In* WMO The Long-Range Transport of Pollutants and its Relation to Gen. Circulation Including Stratospheric/Tropospheric Exchange Processes 1979 12 p refs (For primary document see N80-26888 17-45)
(Grants EPA-R-803896; EPA-R-806548)
Avail: NTIS HC A19/MF A01

Sulfate aerosol from fossil fuel combustion can be monitored on the regional scale by relating it to reduced visual range measured at most meteorological stations. The synoptic or regional scale is shown to be appropriate for the impact assessment of sulfates and other agrosols. A global pollution dispersion model is presented, based upon projected fossil fuel combustion and hemispheric winds. Author (ESA)

N80-26943# Netherlands Organization for Applied Scientific Research TNO, Delft.
PHOTOCHEMICAL SMOG FORMATION IN THE NETHERLANDS
Robert Guicherit, ed. Oct. 1978 209 p refs Sponsored by Dutch Min. of Public Health and Environ. Hyg.
Avail: NTIS HC A10/MF A01

Problems encountered in smog formation and air pollution diffusion studies are presented. The determination of peroxybenzoyl nitrate in ambient air, volumetric ultraviolet measurements as a parameter of photochemical smog formation, and sources of primary (precursor) pollutants are among the topics covered. The experimental and mathematical simulation of photochemical air pollution as well as a simple air quality simulation model are also studied. Finally, the adverse effects of using polyvinyl fluoride in smog chamber experiment and a classification of organic compounds by their contributions to air pollution are shown. For individual titles, see N80-26944 through N80-26954.

N80-26944# Netherlands Organization for Applied Scientific Research TNO, Delft.
RESOLVED AND UNRESOLVED ISSUES IN PHOTOCHEMICAL AIR POLLUTION STUDIES
J. vanHam *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 1-19 refs (For primary document see N80-26943 17-45)
Avail: NTIS HC A10/MF A01

Key issues in oxidant control to improve air quality are defined and reviewed relative to the situation in the Netherlands. These are oxidant/ozone measurement, stratospheric ozone intrusion, natural organic emissions, reactivity, 'smog chamber method' evaluation, oxidant transport, current air quality simulation model utility, and optimum oxidants control strategy. Some of the conclusions that can be drawn from the review are dramatic, because they indicate that even after three decades of scientific research knowledge of the phenomenon of photochemical air pollution is still essentially inadequate. Author (ESA)

N80-26945# Netherlands Organization for Applied Scientific Research TNO, Delft.
ATMOSPHERIC PRECURSORS AND OXIDANT CONCENTRATIONS IN THE NETHERLANDS
R. Bos, E. Goudena, Robert Guicherit, A. Hoogeveen, and J. deVreede *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 20-59 refs (For primary document see N80-26943 17-45)
Avail: NTIS HC A10/MF A01

The measuring of photochemical oxidants and precursors as part of a program on photochemical smog formation is described. An emission inventory of nitrogen oxides for the Netherlands is presented. Trends in air quality for primary pollutants are shown. The determination and analysis of atmospheric levels of hydrocarbons, mainly by gas chromatographic techniques, are discussed. Results show that for both nitrogen oxides and hydrocarbons emitted by mobile sources an upward trend in concentration levels exists. Ambient air quality for NO2 falls between 0.05 ppm and 0.02 ppm (daily average). Ambient air quality for nonmethane hydrocarbons frequently exceeds 0.24 ppm when sampling between 6:00 and 9:00 am (three hourly average). Next, aircraft measurements of ozone levels are examined. Maximum recorded hourly ozone concentrations during smog forming episodes often reach values of over 0.35 ppm while, maximum peak concentrations of peroxyacetylnitrate up to 20 ppb were recorded. Author (ESA)

N80-26946# Netherlands Organization for Applied Scientific Research TNO, Delft.

DETERMINATION OF PEROXYBENZOYL NITRATE (PBzN) IN AMBIENT AIR

G. M. Meijer and H. Nieboer *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 60-63 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

A method for measuring peroxybenzoyl nitrate (PBzN) in ambient air by gas liquid chromatography with flame ionization detection is described. After an extensive test program to assure the accuracy of the method, PBzN was measured during a period of a few weeks (with anticyclonic conditions over northwest Europe) to analyze outdoor air. Results confirm thAt PBzN occurs in ambient air. It is noted that the levels measured are relatively high (an average of 4.6 ppb between 2:00 and 4:00 pm) and not far from the levels at which eye irritation can be expected.

Author (ESA)

N80-26947# Netherlands Organization for Applied Scientific Research TNO, Delft.

THE WEEK-END EFFECT

P. J. Blokzijl and Robert Guicherit *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 64-67 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

A statistical investigation of air quality data was conducted in order to determine whether any one day of the week had a tendency towards higher pollutant indexes than any other. A nonparametrical analysis of variance test was used. Results imply that for ozone, concentration levels on weekends and weekdays are similar in most urban and suburban areas despite markedly different precursor emission levels; the hydrocarbon to nitrogen oxides ratio is also stable throughout the week. However, the rates of secondary reactions in which nitrogen compounds are involved are higher on weekdays, resulting in higher concentrations of organic and inorganic nitrates. Author (ESA)

N80-26948# Netherlands Organization for Applied Scientific Research TNO, Delft.

VOLUMETRIC ULTRAVIOLET MEASUREMENTS AS A PARAMETER OF PHOTOCHEMICAL SMOG FORMATION

G. Brunner, J. deVreede, and Robert Guicherit *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 68-78 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

A continuous recording actinometer, consisting of a cubical arrangement of six horizontal plate physical sensors, was used to measure volumetric ultraviolet radiation intensity in an urban area. The system was calibrated against the photoisomerization of o-nitrobenzaldehyde to o-nitrosobenzoic acid. Data were used in the study of photochemical reaction models. Results show that an important parameter of photochemical reaction kinetic diffusion models is the rate constant (K) for the photodissociation of NO2 and other chemical components, such as O3, HNO2, H2O2, and aldehydes. For various atmospheric conditions, such as aerosol loading, and depending on solar zenith angle, K may increase about 25% for small zenith angles to more than 60% for zenith angles over 70 deg in the lowest kilometer of the atmosphere. These changes will noticeably effect model calculations. Author (ESA)

N80-26949# Netherlands Organization for Applied Scientific Research TNO, Delft.

SOURCES OF PRIMARY (PRECURSOR) POLLUTANTS

Robert Guicherit and A. Hoogeveen *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 79-88 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

Air pollutant concentrations were measured at a pollution monitoring station and the data correlated with wind direction. Results show that the relative concentrations of hydrocarbons in the atmosphere gives information about their origin. For the areas studied it appears that the composition of hydrocarbons in the atmosphere is entirely different for different wind directions, pointing to different sources. The most important sources for these areas are identified as natural gas leaks, traffic, gasoline spillage, and petrochemical industries. Author (ESA)

N80-26950# Netherlands Organization for Applied Scientific Research TNO, Delft.

EXPERIMENTAL AND MATHEMATICAL SIMULATION OF PHOTOCHEMICAL AIR POLLUTION

H. Nieboer and J. H. Duyzer *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 89-150 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

The properties of a cascade reactor which is suitable for simulating the chemical processes of photochemical air pollution are described. The ozone quantity originating during irradiation of a mixture of carbon monoxide and nitrogen oxides in humid air is determined by the rate of the heterogeneous formation of nitrous acid from nitrogen oxides and water. The rate constant of the formation of nitrous acid deduced from the observed ozone formation is shown to be satisfactory for checking the model with experiments in the nitrogen oxide/hydrocarbon system. The measured formation of ozone and peroxyacetyl nitrate at nitrogen oxide concentrations of less than 100 ppb and propylene nitrogen oxide ratios between 1 and 10 agrees well with the formation calculated on the basis of the model. The dynamic equilibrium of peroxyacetyl nitrate with nitrogen dioxide and acetylperoxy radicals included in the model also agrees well with the behavior of peroxyacetyl nitrate under the influence of light and in the presence of NO. Author (ESA)

N80-26951# Netherlands Organization for Applied Scientific Research TNO, Delft.

AN ACCURACY EVALUATION OF A SIMPLE AIR QUALITY SIMULATION MODEL

H. Nieboer, J. vandenEikhoff, and L. J. J. Wittebrood *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 151-171 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

A box model to simulate changes in air quality due to variations in the rates of pollutant emission, entrainment of pollutants, pollutant transport (by advection), and of light intensity is presented. An evaluation of the model's ability to realistically relate meteorological, emission, and chemical parameters to smog formation is given. Analysis of a simulation shows that for the formation of ozone from hydrocarbons and nitrogen oxides major factors to be considered are wind speed, light intensity, concentrations of pollutants above an inversion, parallel changes in emission of hydrocarbons and nitrogen oxides, and reactions between peroxy radicals and aerosols. Intermediate factors are inversion height, nonparallel changes in the emission of hydrocarbons and nitrogen oxides, and reactions between polar compounds and aerosols. Minor factors to be modeled are temperature as well as reactions between gaseous pollutants and the surface of the Earth (dry deposition). Moreover knowledge of precursor and product concentrations in background areas and in higher air layers is demonstrated to be extremely important for obtaining accurate results by model calculations.

Author (ESA)

N80-26952# Netherlands Organization for Applied Scientific Research TNO, Delft.

OBJECTIONS TO THE USE OF POLYVINYL FLUORIDE IN SMOG CHAMBER EXPERIMENTS

J. vanHam and T. Lems *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 172-177 refs (For primary document see N80-26943 17-45)

Avail: NTIS HC A10/MF A01

The interference of polyvinyl fluoride (PVF) sampling bags in smog chamber experiments was examined. From irradiation experiments and model simulations, results show that the release of organic compounds by PVF causes serious interference when this material is used in these experiments. For this reason, the use of PVF bags in studies of photochemical air pollution is not recommended. The interference manifests itself in such essential parameters as (total) hydrocarbon concentration, NO response, hydrocarbon/NO ratio, and formation of ozone and PAN. The interference decreases with increasing surface-to-volume ratios and with increasing precursor concentrations, but is otherwise difficult to quantify. Author (ESA)

N80-26953# Netherlands Organization for Applied Scientific Research TNO, Delft.

CLASSIFICATION OF A NUMBER OF ORGANIC COMPOUNDS ACCORDING TO THEIR CONTRIBUTIONS TO PHOTOCHEMICAL AIR POLLUTION

H. Nieboer and J. vanHam *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 178-186 refs (For primary document see N80-28943 17-45)
Avail: NTIS HC A10/MF A01

As an aid to choosing the best way to abate photochemical air pollution, a classification of hydrocarbons which typically contribute to smog formation is presented. Photochemical air pollution is attended by ozone formation. The rate constant of the reaction between hydrocarbon and hydroxyl radicals is proposed as a measure of its reactivity and ozone formation potential. It is stressed that the amount of ozone formed in a given parcel of air depends also on the concentrations of hydrocarbons and nitrogen oxides. In order to abate photochemical air pollution in a specific area the restriction of hydrocarbon emissions must be balanced by the restriction of nitrogen oxide emission as well.
Author (ESA)

N80-28954# Netherlands Organization for Applied Scientific Research TNO, Delft.

SOME NOTES ON THE ABATEMENT OF PHOTOCHEMICAL OZONE PRODUCTION

Robert Guicherit, P. L. Blokzijl, and C. J. Plasse *In its* Photochem. Smog Formation in the Netherlands Oct. 1978 p 187-204 refs (For primary document see N80-28943 17-45)
Avail: NTIS HC A10/MF A01

Mathematical models and laboratory as well as field experiments, used to relate emission rates of precursors to oxidant air quality, are reviewed. Two processes (precursor dispersion; photochemical reactions) are elucidated in regards to forming smog abatement strategies. Ozone monitoring is discussed as a means of determining pollution levels. A control strategy aimed at adjusting the ratio of nonmethane hydrocarbons to nitrogen oxides as far away as possible from the optimum for ozone formation is called for.
Author (ESA)

N80-28955# SRI International Corp., Menlo Park, Calif.

CHARACTERIZATION OF THE EPRI DIFFERENTIAL ABSORPTION LIDAR (DIAL) SYSTEM Final Report

R. A. Baumgartner, J. G. Depp, W. E. Evans, W. B. Grant, J. G. Hawley, R. G. March, E. R. Murray, and E. K. Proctor Dec. 1979 103 p ref
(EPRI-EA-1267) Copyright. Avail: Issuing Activity

A differential absorption lidar (DIAL) was developed as a mobile field system for making remote measurements of SO2,NO2, and O2. After field testing, the lidar was prepared for the system calibration testing where lidar measurements were compared to in situ profiles of SO2, NO2, and O3. This program determined overall system accuracy and reliability in measuring varying ambient gas concentrations. Tests were then made using an NO2 sample chamber to simulate a calibrated No2 plume, and ambient measured NO2 concentrations were compared with values from a regional air pollutant monitoring station. Following the local calibration and the systems fields tests, the performance and reliability of the lidar was reevaluated. It was concluded that although the remote measuring capability was successfully demonstrated in the field program, several systems improvements would increase the lidar accuracy and reliability.
DOE

N80-28956# Brookhaven National Lab., Upton, N. Y. Progress Sciences Div.

ENVIRONMENTAL CONTROL TECHNOLOGY FOR ATMOSPHERIC CARBON DIOXIDE Final Report

Anthony S. Albanese and Meyer Steinberg Sep. 1979 58 p refs
(Contracts EY-76-C-02-0016; DE-AC02-76CH-00016)
(BNL-51116) Avail: NTIS HC A04/MF A01

The impact of fossil fuel use in the United States on worldwide CO2 emissions and the impact of increased coal utilization on CO2 emission rates are assessed. The aspects of CO2 control are discussed as well as the available CO2 control points (CO2 removal sites). The primary factor affecting the practicability of a CO2 control system is the energy required by the control system. Of the three potential CO2 control points, removal from the stacks of fossil fuel power plants appears to require the least amount of energy. Estimates of the energy required to capture and recover CO2 from coal-fired power plant stacks by various processes are presented. Although capture and recovery of CO2 is an important consideration in the overall scheme of CO2 control, disposal or reuse of recovered CO2 may be the weakest link in the CO2 control chain. Of the several options considered, deep ocean storage appears to be the most promising. Two control scenarios are evaluated, one based on the absorption of CO2 contained in power plant flue gas by seawater; the other, based on absorption of CO2 by monoethanolamine (MEA). Captured CO2 is injected into the deep ocean in both cases. Analysis indicate that capture and disposal by seawater is not feasible, whereas capture and disposal using MEA is a possibility. However, the economic penalties of CO2 control are significant; for example, at a CO2 removal efficiency of 50%, it is estimated that the power generation efficiency of a conventional coal fired power plant would be reduced from 34 to about 25%. The cost of power generation would be expected to double. For 90% CO2 removal, power generation efficiency is reduced to between 15 and 6% and the cost of power generation increases by a factor of from 4 to 7.
DOE

N80-28957# California Univ., Livermore. Lawrence Livermore Lab.

POTENTIAL CHANGES TO STRATOSPHERIC OZONE FROM POSSIBLE CHLOROFLUOROCARBON PRODUCTION

Donald J. Wuebbles and Raymond L. Tarp 17 Mar. 1980 35 p refs
(Contract W-7405-eng-48)
(UCID-18583) Avail: NTIS HC A03/MF A01

Atmospheric emission rates of the chlorofluorocarbons CFC13 are discussed. Potential industrial production and commerical applications, and the eventual release of these chemicals into the atmosphere are examined. The potential effect on stratospheric ozone resulting from future chlorofluorocarbon emissions as suggested by these scenarios are examined. Assessments are based upon model calculations using the one dimensional coupled transport and chemical kinetics model of the troposphere and stratosphere.
DOE

N80-28958# Colorado Univ., Boulder.

HETEROGENEOUS CHEMISTRY OF IMPORTANCE IN DECISIONS CONCERNING THE ENVIRONMENTAL IMPACT OF ENERGY PRODUCTION AND THE SITING OF NEW ENERGY SOURCES Progress Report, 1 Mar. 1979 - 29 Feb. 1980

A. W. Castleman, Jr. Feb. 1980 17 p refs
(Contract EP-78-S-02-4776)
(COO-4776-2) Avail: NTIS HC A02/MF A01

The following are reported: (1) the formation, stability, and structure of ion-clusters both by high pressure mass spectrometric experiments and approximate molecular orbital quantum mechanical calculations; (2) the exchange of energy and angular momentum during ion-molecule association reactions using computer dynamics calculations; (3) related experimental and theoretical studies of nucleation and solvation phenomena; (4) laser photophysics of ion clusters including measurement of cross sections for photodissociation, fluorescence, and energy exchange by pulsed infrared techniques; (5) the growth, stability, and structure of weakly-bound van der Waals and charge-transfer complexes employing electric deflection techniques and taking advantage of the first-order Stark effect; and (6) the multiphoton ionization of metal atom clusters to prove the transition from the isolated atomic to the condensed metallic state, and to elucidate their electronic states and potential as sites for the catalytic conversion of absorbed pollutants.
DOE

N80-28959# Department of Energy, Washington, D. C. Office of Health and Environmental Research.

CARBON DIOXIDE EFFECTS RESEARCH AND ASSESSMENT PROGRAM. CARBON DIOXIDE RESEARCH Progress Report, Fiscal Year 1979

Roger C. Dahlman, Thomas Gross, Lester Machta (NOAA, Silver Spring, Md.), William Elliott (NOAA, Silver Spring, Md.), and Michael MacCracken (Calif. Univ., Livermore, Lawrence Livermore Lab.) Apr. 1980 88 p refs
(DOE/EV-0071) Avail: NTIS HC A05/MF A01

Research on the global carbon cycle and the effects of increased carbon dioxide on the global climate system is reported.

Environmental and societal effects related to CO2 and environmental control technology for CO2 are also discussed. Lists of research projects, reports, and publications of the Carbon Dioxide and Climate Research Program are included. An expanded CO2 monitoring network is providing increased coverage for interpretation of patterns of sources and sinks seasonal variability and documentation of the global growth of CO2. Initial studies in the equatorial Pacific are helping quantify estimates of the amount of outgassing CO2 from tropical waters. Model simulations of the effect of doubled CO2 concentration carried out with fixed ocean temperatures showed relatively small summer heating over land areas. On the other hand, simulations in which the oceanic temperatures could come into instantaneous equilibrium with atmospheric conditions continued to show global temperature increases of 3 + or - 1.5 C, accentuated at high latitudes. DOE

N80-26960# New Jersey Inst. of Tech., Newark. Air Pollution Research Lab.
ANALYSIS OF SELECTED VOLATILE ORGANIC SUBSTANCES IN AMBIENT AIR Final Report, Apr. - Nov. 1978
Joseph W. Bozzelli and Barbara B. Kerbekus Oct. 1979 80 p refs
(PB80-144694; NJDEP-79/02) Avail: NTIS HC A05/MF A01 CSCL 07D

Sampling/analytical methodologies and laboratory techniques in determining the concentrations of selected volatile organic substances in the vapor phase are described. A total of 330 samples from northern New Jersey were collected. The samples were then analyzed for benzene, carbon tetrachloride, chloroform, o- and p-dichlorobenzene, 1,2-dichloroethane, nitrobenzene, tetrachloroethylene, 1,1,1-trichloroethane, trichloroethylene, and vinyl chloride. Full data sets for all samples are appended to the report. GRA

N80-26961# Wisconsin Univ., Madison. Dept. of Statistics.
STATISTICAL ANALYSIS OF THE LOS ANGELES CATALYST STUDY DATA
Johannes Ledolter, George C. Tiao, Spencer B. Graves, Jian-Tu Hsieh, and Gregory B. Hudak Oct. 1979 88 p refs
(Contract EPA-68-02-2261)
(PB80-144439; EPA-600/4-79-070) Avail: NTIS HC A05/MF A01 CSCL 04A

Statistical analyses of the data from the Los Angeles Catalyst Study were performed in order to determine the effects of the introduction of the catalytic converter upon the atmospheric concentration levels of a number of air pollutants. Analysis of the CO, Pb, SO4, O3, NO and NO2 data covering the period from June 1974 to November 1977 is presented. Models were built to evaluate the freeway contribution to CO and Pb as a function of traffic, windspeed, and wind direction. The models were used to assess both the time trend in the pollutant measurements and the pollution concentrations at points near the freeway. Frequency distributions for ambient air quality data near freeways are discussed. GRA

N80-26962# Cambridge Systematics, Inc., Mass.
TRANSPORTATION AIR QUALITY ANALYSIS - SKETCH PLANNING METHODS. VOLUME 1: ANALYSIS METHODS Final Report
Dec. 1979 284 p refs Sponsored in part by DOT
(Contract EPA-68-01-4977)
(PB80-158702; EPA-400/1-80-001A-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 13B

Analytical methodologies are described for use by metropolitan planning organizations and other state and local transportation agencies in analyzing the air quality potential of candidate urban transportation measures. As sketch planning techniques, the methods are designed to produce first-cut estimates of a proposed transportation measure's impact for a relatively small investment of time and effort. Quantitative methods oriented to auto restricted zones, high occupancy vehicle priorities, transit improvements, parking programs, carpool/vanpool incentives, and staggered work hours are provided. The methods use worksheet, programmable calculator, and computerized approaches to apply disaggregate behavioral models. They can be used to predict traveller demand as a function of transportation system characteristics, transportation facility operations as a function of their usage and their physical characteristics, and special impacts including vehicular emissions, fuel consumption, and operating costs. Guidelines are provided both to those responsible for designing the transportation-air quality analysis approaches in specific local areas, and to those who will carry out these analyses. In addition, references are provided to documents which provide additional detail on the methods. GRA

N80-26963# University of Southern California, Los Angeles.
A BIOLOGIC INDICATOR FOR AIR POLLUTION
Russell P. Sherwin Sep. 1979 85 p refs
(Grants EPA-R-800881; EPA-R-804545)
(PB80-143274; EPA-600/1-79-038) Avail: NTIS HC A05/MF A01 CSCL 06F

Guinea pigs and mice were exposed to low levels of nitrogen dioxide either continuously or on an intermittent schedule in order to develop highly sensitive discriminants involving correlations of structural and functional alterations. The two major test areas developed were the quantitative measurements of type 2 cell populations and protein leakage with in the lung. It is concluded that the research data supports the hypothesis that to properly evaluate the possible health effects from air pollutants one must give attention to the subclinical cellular alterations that deplete the functional and structural reserves of organs which are the primary target for air pollutants. GRA

N80-26964# Booz-Allen and Hamilton, Inc., Florham Park, N.J. Foster D. Snell Div.
ECONOMIC IMPACT OF IMPLEMENTING RACT GUIDELINES IN THE NON-ATTAINMENT AREAS FOR OZONE IN SOUTH CAROLINA Final Report
Mar. 1979 294 p refs
(Contract EPA-68-02-2544)
(PB80-134067; EPA-904/9-79-032) Avail: NTIS HC A13/MF A01 CSCL 13B

The direct economic impact of implementing reasonably available control technology -(RACT) standards in five non-attainment counties for ozone in South Carolina was investigated. The economic impact was assessed for the following 8 RACT industrial categories: surface coatings (paper and fabrics); solvent metal cleaning; bulk gasoline terminals; bulk gasoline plants; storage of petroleum liquids in fixed roof tanks; gasoline dispensing stations-Stage 1; and use of cutback asphalt. Direct economic costs and benefits from the implementation of RACT limitations were identified and quantified. Secondary impacts (social, energy, employment, etc.) are also discussed. GRA

N80-26965# AeroVironment, Inc., Pasadena, Calif.
OZONE AND PRECURSOR TRANSPORT INTO AN URBAN AREA: EVALUATION OF MEASUREMENT APPROACHES Final Report
Michael W. Chan, Douglas W. Allard, and Ivar Tombach Dec. 1979 166 p refs
(Contract EPA-68-02-3027)
(PB80-153927; EPA-450/4-79-039) Avail: NTIS HC A08/MF A01 CSCL 13B

Five techniques for measuring the transport of ozone and precursors into an urban area are evaluated. The techniques were tested in Philadelphia during the summer of 1978. The data collected in the field program indicate that, in general, advection of ozone aloft is the main route by which pollution of photochemical interest is transported into Philadelphia. Transport of ozone along the surface and transport of oxides of nitrogen and non-methane hydrocarbons, both aloft and along the surface, are minimal. Thus, the recommended techniques must primarily be able to quantify the ozone transported aloft. Of the five techniques, three were determined applicable for quantifying the ozone transported aloft. GRA

N80-26966# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
DESIGN CRITERIA FOR STATIONARY SOURCE CATALYTIC COMBUSTION SYSTEMS
J. P. Kesselring, W. V. Krill, H. L. Atkins, R. M. Kendall, and J. T. Kelly Aug. 1979 457 p refs
(Contract EPA-68-02-2116)
(PB80-147317; EPA-600/7-79-181; Rept-78-278) Avail: NTIS HC A20/MF A01 CSCL 13B

An investigation of the applicability of catalytic combustion to stationary gas turbine, boiler, and furnace systems is reported. System operating characteristics and potential for NOx emmisions reduction are identified. An experimental program was conducted to develop catalyst materials and combustor concepts with useful heat extraction. GRA

N80-26967# Rockwell International Corp., Creve Coeur, Mo. Environmental Monitoring and Service Center.
REGIONAL AIR POLLUTION STUDY. CARBON DIOXIDE EFFECTS ON RAMS (REGIONAL AIR MONITORING SYSTEM) SULFUR MONITORS Final Report
D. H. Hern Oct. 1979 42 p refs
(Contract EPA-68-02-2093)
(PB80-137508; EPA-600/4-79-065) Avail: NTIS HC A03/MF A01 CSCL 13B

Effects of carbon dioxide (CO2) content of the air on the response of flame photometric sulfur gas analyzers of two types, the Tracor model 270 HA sulfur chromatograph and the Meloy model SA 185 total sulfur analyzer are examined. These analyzers were used in the regional air monitoring system (RAMS). For each instrument, measurements were made to determine response to a matrix of five CO2 levels and three sulfur dioxide (SO2) levels. Measurements were also made of CO2 concentrations in the influent to and effluent from heatless air dryers providing zero air for calibration at the RAMS stations. GRA

N80-26968# New Jersey Inst. of Tech., Newark Air Pollution Research Lab.
LEAD AND TOXIC METALS IN AIRBORNE PARTICULATES Final Report, Apr. - Nov. 1978
Joseph W. Bozzelli and Barbara B. Kebbekus Oct. 1979 92 p refs
(PB80-137201; NJDEP-79/03) Avail: NTIS HC A05/MF A01 CSCL 07D

The first phase of a planned multi-year investigation of air quality in New Jersey is described. The development of sampling and analytical methodologies and laboratory techniques in determining the concentrations of selected metals in airborne particulates through use of atomic absorption spectroscopy is detailed. A total of 102 samples were collected in portions of northern New Jersey using high volume samplers. Twenty-one of these were separated into five fractions by size using cascade impaction samplers. Samples were analyzed for arsenic, cadmium, lead, manganese, mercury, nickel and zinc, and data sets for all samplers are appended. GRA

N80-26969# Monsanto Research Corp., Dayton, Ohio.
PORTABLE MINIATURE SAMPLER FOR POTENTIAL AIRBORNE CARCINOGENS IN MICROENVIRONMENTS. PHASE 1, DEVELOPMENT Interim Report, Sep. 1977 - Oct. 1978
J. J. Brooks and D. S. West Jan. 1980 92 p refs
(Contract EPA-68-02-2774)
(PB80-150105; EPA-600/2-80-026) Avail: NTIS HC A05/MF A01 CSCL 13B

Research towards the development of a portable, miniature, sorbent-type collection system for sampling and preconcentrating organics in general, and carcinogens and associated compounds (e.g., mutagens, precarcinogens, and cofactors) in particular, from ambient air is discussed. Progress is described concerning the following: (1) the selection of candidate sorbent materials; (2) the selection of test compounds for sorbent evaluation; (3) the evaluation of the sorbent materials in terms of capacity, desorption properties, and physical properties that relate to pressure drops and ultimate system design; and (4) the selection of a three-sorbent system based on Tenax-GC, Porapak R, and Ambersorb. GRA

N80-26970# Industrial Environmental Research Lab., Research Triangle Park, N. C.
PARTICULATE CONTROL HIGHLIGHTS: RESEARCH AT HIGH TEMPERATURE/PRESSURE
Dennis C. Drehmel and James H. Abbot Dec. 1979 25 p refs
(PB80-149891; EPA-600/8-79/031B) Avail: NTIS HC A02/MF A01 CSCL 13B

Environmental Protection Agency (EPA) high temperature and high pressure programs, aimed at demonstrating control technology to meet enviromental standards for the ambient concentration of particles and the emission rate of particles from new sources, are highlighted. Among the control devices considered in the EPA programs are cyclones, granular bed filters, dry scrubbers, molten scrubbers, electrostatic precipitators, ceramic bag filters, and other ceramic filters. Advantages and disadvantages of the devices involve parameters such as simplicity of operation, materials problems, inability to collect submicron particles, difficulty in regenerating the collection media, and those related to cost, including size and pressure drop. GRA

N80-26971# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
EVALUATION OF HC (HYDROCARBON) CONTROL STRATEGIES FOR GENERAL AVIATION PISTON ENGINES
Richard S. Wilcox Jul. 1979 19 p refs
(PB80-155393; EPA-AA-SDSB-79-17) Avail: NTIS HC A02/MF A01 CSCL 01C

The cost effectiveness of controlling hydrocarbon (HC) exhaust emissions from general aviation piston powered aircraft is evaluated. Recent analyses have indicated that these aircraft are not major contributors to violations of the National Ambient Air Quality Standard for CO which adversely affect the public health and welfare. Although HC emissions from general aviation are also small when compared to many other sources, the oxidant problem is so widespread that all reasonable controls should be implemented. GRA

N80-26972# Environmental Monitoring and Support Lab., Research Triangle Park, N. C. Quality Assurance Div.
TECHNICAL ASSISTANCE DOCUMENT FOR THE CALIBRATION OF AMBIENT OZONE MONITORS Final Report
Richard J. Paur and Frank F. McElroy Sep. 1979 72 p refs
(PB80-149552; EPA-600/4-79-057) Avail: NTIS HC A04/MF A01 CSCL 14B

In February, 1979, EPA revised certain parts of the ambient air pollution monitoring regulations to specify a new procedure for calibration of ambient ozone analyzers. The new procedure is based on ultraviolet (UV) absorption photometry, and specifies in detail the UV photometer, other apparatus, and the procedure necessary for establishing quasi-primary ozone concentration standards derived from the known absorption coefficient of ozone at 254 nm. In order to help agencies and organizations which must use the new procedure, absorption photometry is discussed with emphasis on the transmittance measurement and measurement errors. Step-by-step explanatory information and advice keyed to each paragraph of the procedure is presented. Ultraviolet photometers, their design and operational characteristics, and several commercially available models are described. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-26973 Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de Physique Generale.
STUDY OF TRACE CONSTITUENTS IN THE ATMOSPHERE BY ABSORPTION SPECTROMETRY Final Report [VARIATIONS SAISONNIERES ET CLIMATIQUES DE CONSTITUANTS STRATOSPHERIQUES A L'ETAT DE TRACE]
Andre Girard, Jean Besson, Renee Giraudet, and Louis Gramont 16 Nov. 1977 89 p refs Partly in ENGLISH and FRENCH
(Contract DGRST-76-6-1051)
(ONERA-RF-2/3376-PY) Avail: NTIS HC A05

Measurements by infrared absorption spectrometry using the Sun as a source at sunset or at sunrise are presented. The experiments were performed in November 1976 as part of the 'latitude survey mission' from the NASA Convair 990 between 72 deg N and 52 deg S, the flight altitude was 11 km. The instrument, which is essentially a spectrometer associated with a Sun tracker automated through a control module, is briefly

described. Five spectral intervals were scanned for the purpose of measuring: NO, NO2, HCl, HNO3, O3, CH4, and H2. The results show the correlated seasonal and climactic variations of trace constituents. Author (ESA)

N80-28974# World Meteorological Organization, Geneva (Switzerland).
THE PLANETARY BOUNDARY LAYER
G. A. McBean, ed., K. Bernhardt, S. Bodin, Z. Litynska, A. P. VanUlden, J. C. Wyngaard, B. R. Kerman, J. D. Reid, Z. Serbjan, and J. L. Wolmsley 1979 215 p refs Original contains color illustrations
(TN-165; WMO-530) Avail: NTIS HC A10/MF A01

An introduction to the general properties of the planetary boundary layer is given. The status and structural aspects are reviewed with an emphasis on presenting the physical insights to problems. The Ekman layer is discussed in detail with emphasis on the semi-empirical and resistance low descriptions. The tropical boundary layer is discussed. The important differences between the tropical and higher latitude boundary layers are addressed. The modelling of the atmospheric boundary layer is studied. Both research and operational types of models are reviewed. The observational methods used in boundary-layer meteorology are presented and the major observational programs that have been conducted are described. The applications of boundary layer knowledge are discussed. Three topics, the estimation of surface fluxes, aeronautical meteorology and urban boundary layers are presented in some detail while two further topics, electromagnetic and acoustic wave propagation and problems of mountain meteorology and climatology related to the boundary layer, are briefly reviewed. F.O.S.

N80-28975# Geological Survey, Washington, D. C.
EARTHQUAKES IN THE UNITED STATES, JANUARY TO MARCH 1978
C. W. Stover, J. H. Minsch, and B. G. Reagor 1980 32 p refs
(Circ-819-A) Avail: NTIS HC A03/MF A01

A complete listing of macroseismic effects of earthquakes is presented for use in risk studies, nuclear power plant site evaluations, and seismicity studies. The earthquakes are listed in chronological order by state indicating data, origin time, hypocenter, magnitude, and maximum intensity. F.O.S.

N80-28976# Geological Survey, Washington, D. C.
SEISMIC ENGINEERING PROGRAM REPORT, JANUARY TO APRIL 1979
1979 25 p refs
(Grant NSF CA-114)
(Circ-818-A) Avail: NTIS HC A02/MF A01

Summaries of the accelerograms recovered from the U.S. Geological Survey's National Strong-Motion Network are presented. Strong-motion instrumentation in the Imperial Valley, California is reported along with information on strong-motion sources. F.O.S.

N80-28977*# Indiana Univ., Bloomington.
THE ORIGIN AND EVOLUTION OF SULFUR IN AN ARCHEAN VOLCANO-SEDIMENTARY BASIN, DEER LAKE AREA, MINNESOTA M.S. Thesis
Dorian L. Nicol May 1980 61 p refs
(Grant NsG-7520)
(NASA-CR-163285) Avail: NTIS HC A04/MF A01 CSCL 08G

Rocks of the Deer Lake area, northcentral Minnesota, consist of Archean (age greater than 2.6 billion years) metasediments and metavolcanics intruded by mafic layered sills. Geologic and sulfur isotopic data suggest that sulfides in the sediments are bacteriogenic, having formed in response to the activity of sulfate reducing bacteria during diagenesis. Deposition of the sediments appears to have occurred in a deep marine basin with restricted circulation of sea water. The bulk of the sulfur in the igneous rocks is of deep seated origin, but basal contacts of the sills show evidence of assimilation of biogenic sulfur from the intruded sediments. This assimilation of biogenic sulfur is the primary geochemical control of local Cu-Ni sulfide mineralization. Author

N80-28978*# Indiana Univ., Bloomington. Dept. of Geology.
SULFUR ISOTROPIC STUDIES OF ARCHEAN SLATE AND GRAYWACKE FROM NORTHERN MINNESOTA: EVIDENCE FOR THE EXISTENCE OF SULFATE REDUCING BACTERIA
Edward M. Ripley and Dorian L. Nicol 1979 33 p refs
(Contract NsG-7520)
(NASA-CR-163286) Avail: NTIS HC A03/MF A01 CSCL 08G

Sulfur isotopic studies of pyrite from metasediments in the > 2.6 b.y. old Deer Lake greenstone sequence, Minnesota, were conducted in order to evaluate the possible importance of sulfate reducing bacteria in sulfide formation. Pyrite occurs as ovules up to 2 cm in diameter within graphitic slates, and as fine disseminations in metagraywacke units. SEM studies indicate the pyrite is framboidal in morphology. Delta notation values of pyrite from the Deer Lake sediments range from -2.3 to 11.1 o/oo, with a peak at approximately +2 o/oo. Isotopic data is consistent with either high temperature inorganic reduction of circulating seawater sulfate, or low temperature bacterial reduction. However, the lack of sulfide bands or massive occurrences in the sediments, the restriction of pyrite mineralization to the sediments, and the absence of evidence for hot spring activity suggest that a diagenetic origin of pyrite is more feasible. Sulfide in such an environment would be produced principally by the action of sulfate reducing bacteria. Author

N80-28979*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
APPLICATION OF LASER RANGING AND VLBI DATA TO A STUDY OF PLATE TECTONIC DRIVING FORCES Final Report, 1 May 1979 - 30 Apr. 1980
Sean C. Solomon 30 Apr. 1980 111 p refs Presented at Conf. on the Magnitude of Deviatoric Stresses in the Earth's Crust and Upper Mantle, Carmel, Calif., 29 Jul. - 2 Aug. 1979; sponsored by U.S. Geological Survey
(Contract NCCS-14; Grants NSG-7329; NSF EAR-78-1293C) (NASA-CR-163019) Avail: NTIS HC A06/MF A01 CSCL 08G

The conditions under which changes in plate driving or resistive forces associated with plate boundary earthquakes are measurable with laser ranging or very long base interferometry were investigated. Aspects of plate forces that can be characterized by such measurements were identified. Analytic solutions for two dimensional stress diffusion in a viscoelastic plate following earthquake faulting on a finite fault, finite element solutions for three dimensional stress diffusion in a viscoelastic Earth following earthquake faulting, and quantitative constraints from modeling of global intraplate stress on the magnitude of deviatoric stress in the lithosphere are among the topics discussed. J.M.S.

N80-28980*# Ohio State Univ. Research Foundation, Columbus. Dept. of Physics.
INVESTIGATION OF INFRARED SPECTRA OF ATMOSPHERIC GASES TO SUPPORT STRATOSPHERIC SPECTROSCOPIC INVESTIGATIONS Semiannual Report, 1 Nov. 1979 - 30 Apr. 1980
John H. Shaw Jun. 1980 30 p refs
(Grant NsG-7479)
(NASA-CR-163018) Avail: NTIS HC A03/MF A01 CSCL 04A

Spectroscopic instrumentation and the absorption characteristics of atmospheric gases are discussed in relation to the requirements of spectroscopic stratospheric experiments. Improvement in the spectral resolution, accuracy of the line parameters, and the ranges of atmospheric conditions over which information is to be obtained are among the factors considered. Methods of simultaneously analyzing entire bands containing many lines were developed and applied to the analysis of bands of N2O and CO2. Progress in this analysis is reported. J.M.S.

N80-28981# Naval Civil Engineering Lab., Port Hueneme, Calif.
SEISMIC SOIL LIQUEFACTION STUDIES Final Report, Oct. 1978 - Oct. 1979
J. B. Forrest, J. M. Ferritto, and G. Wu Dec. 1979 39 p refs (YF53534091)
(AD-A081944; CEL-TN-1566) Avail: NTIS HC A03/MF A01 CSCL 08/13

Earthquake-induced soil liquefaction is considered from the points of view of site evaluation technology, and computer-based analytical developments. In-situ expedient testing procedures are compared with the results of laboratory testing on undisturbed samples. Several types of friction cone penetrometer tests are described, and mechanical cone, electrical cone, and piezometric cone sounding data are compared. Recent developments on analytical effective stress soil models are discussed. Liquefaction behavior is separated into two categories: (1) the inherently unstable situation wherein in-situ stress exceeds residual strength; and (2) the case where accumulation of deformation reaches unacceptable levels. It is suggested that the accumulated deformations category cannot be adequately evaluated using available experimental procedures, but must depend upon effective stress soil model development. GRA

N80-26982# Argonne National Lab., Ill. Energy and Environmental Systems Div.

PROCEEDINGS OF THE WORKSHOP ON IONOSPHERIC AND MAGNETOSPHERIC EFFECTS OF SATELLITE POWER SYSTEMS (SPS)

Dec. 1979 106 p refs Workshop held at Rosemont, Ill., 28-30 Aug. 1978

(Contract W-31-109-eng-38)

(CONF-7808115) Avail: NTIS HC A06/MF A01

Atmospheric effects of a satellite power system are discussed. Atmospheric effects originating from the release of rocket propellant emissions into the ionosphere and magnetosphere are discussed. A listing of potentially important issues with assigned importance ratings; explanations of each issue and diagrams illustrating the interrelationships between the various satellite power systems causes and identified potential atmospheric effects, and possible final impacts, recommendations for both short and long term research objectives, and recommended approaches to achieve those objectives are presented. DOE

N80-26983# Toronto Univ. (Ontario). Dept. of Mechanical Engineering.

A MODEL FOR THE ANGULAR DISTRIBUTION OF SKY RADIANCE

F. C. Hooper and A. P. Brunger Aug. 1979 7 p refs Presented at Joint ASME/AIChE 18th Natl. Heat Transfer Conf., San Diego, Calif., 6-8 Aug. 1979

(Contract EY-76-C-02-2939)

(DOE-CS-32939-9; CONF-790808-23) Avail: NTIS HC A02/MF A01

A flexible mathematical model is introduced which describes the radiance of the dome of the sky under various conditions. This three component continuous distribution (TCCD) model is compounded by the superposition of three separate terms, the isotropic, circumsolar and horizon brightening terms, each representing the contribution of a particular sky characteristic. In use a particular sky condition is characterized by the values of the coefficients of each of these three terms, defining the distribution of the total diffuse component. The TCCD model was demonstrated to fit both the normalized clear sky data and the normalized overcast sky data with an RMS error of about ten percent of the man overall sky radiance. By extension the model could describe variable or partly clouded sky conditions. The model can aid in improving the prediction of solar collector performance. DOE

N80-26984*# Uppsala Ionospheric Observatory (Sweden).

TRIGGER, AN ACTIVE RELEASE EXPERIMENT THAT STIMULATED AURORAL PARTICLE PRECIPITATION AND WAVE EMISSIONS

G. Holmgren, R. Bostroem, M. C. Kelley (Cornell Univ.), P. M. Kintner (Cornell Univ.), R. Lundin (Kiruna Geophys. Inst., Sweden), U. V. Fahleson (Roy. Inst. of Technol., Stockholm), E. A. Bering (Houston Univ.), and W. R. Sheldon Jul. 1979 34 p refs Submitted for publication Sponsored by NASA, NSF, and Swedish Board for Space Activities

(NASA-CR-163255; UIO-SR-79-02) Avail: NTIS HC A03/MF A01 CSCL 04A

The experiment design, including a description of the diagnostic and chemical release payload, and the general results are given for an auroral process simulation experiment. A drastic increase of the field aligned charged particle flux was observed over the approximate energy range 10 eV to more than 300 keV, starting about 150 ms after the release and lasting about one second. The is evidence of a second particle burst, starting one second after the release and lasting for tens of seconds, and evidence for a periodic train of particle bursts occurring with a 7.7 second period from 40 to 130 seconds after the release. A transient electric field pulse of 200 mv/m appeared just before the particle flux increase started. Electrostatic wave emissions around 2 kHz, as well as a delayed perturbation of the E-region below the plasma cloud were also observed. Some of the particle observations are interpreted in terms of field aligned electrostatic acceleration a few hundred kilometers above the injected plasma cloud. It is suggested that the acceleration electric field was created by an instability driven by field aligned currents originating in the plasma cloud. Author (ESA)

N80-26985# Oulu Univ. (Finland). Dept. of Physics

ON THE DISCREPANCY BETWEEN THE MAGNETIC D-COMPONENT AND THE OVERHEAD HORIZONTAL CURRENT AT HIGH LATITUDES

L. Jalonen and T. Nygren Oct. 1978 20 p refs Sponsored in part by Finnish Acad. of Sci.

(Rept-66/1978; ISBN-951-42-0645-2) Avail: NTIS HC A02/MF A01

The discrepancy between the overhead E-region current and the magnetic D-component is studied using data obtained by the Chatanika incoherent scatter radar (L - 5.8). The F-region horizontal current is estimated to be too small to cause the observed D-deflection. Also, the assumption that the magnetic effects of the Pederson and field-aligned currents cancel each other on the ground is shown to be inadequate to solve the problem. The significance of the inclination angle in the data analysis and the importance of the field aligned current sheets are discussed. Author (ESA)

N80-26986# Technology Service Corp., Santa Fe, N. Mex.

EXISTING VISIBILITY LEVELS IN THE UNITED STATES. ISOPLETH MAPS OF VISIBILITY IN SUBURBAN/NONURBAN AREAS DURING 1974 - 1976 Interim Report, May - Sep. 1978

John Trijonis and Dawn Shapland Sep. 1979 35 p refs

(Grant EPA-802815)

(PB80-156177; EPA-450/5-79-010) Avail: NTIS HC A03/MF A01 CSCL 04A

Maps are prepared which illustrate median, midday visibility levels in suburban/ nonurban locations of the continental United States. Median visibilities at 94 locations are determined from cumulative frequency distributions of quality-checked airport observations. Seven locations in the Southwest with photographic photometery of nephelometry data (which agree quite well with the airport data) are also included. The spatial pattern of visibility is demonstrated with isopleth maps for both the annual medians and summertime medians during the years 1974-1976. GRA

N80-26987# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

THE USE OF RADAR OBSERVATIONS OF (C-2) SUB N VS. HEIGHT TO DEDUCE HEIGHT PROFILES OF REFRACTIVE INDEX

E. E. Gossard Dec. 1979 55 p refs

(PB80-160963; NOAA-TM-ERL-WPL-47; NOAA-80020501) Avail: NTIS HC A04/MF A01 CSCL 04A

The possibility of significantly improving the height resolution and accuracy of the standard radiometric retrieval methods by adding information from active radar sounding of the clear atmosphere is examined. Evidence is presented that the intensity is closely related to the height gradient of the refractive index. GRA

N80-26988# National Geodetic Survey, Rockville, Md.

DETERMINATION OF THE GEOPOTENTIAL FROM SATELLITE-TO-SATELLITE TRACKING DATA

B. C. Douglas, C. C. Goad, and F. F. Morrison Jan. 1980 36 p refs

(PB80-161086; NOAA-TM-NOS-NGS-24) Avail: NTIS HC A03/MF A01 CSCL 08E

Simulations were made of the recovery of mean gravity anomalies from intersatellite Doppler measurements. A pair of

surface-force compensated satellites was assumed to be in identical polar orbits, spaced by 3 degrees, at an altitude of 200 km, taking intersatellite data with a precision of 0.001 mm/s. The results for a half-year mission indicate that 1 degree by 1 degree mean gravity anomalies can be obtained to a precision of a few milligals. In contrast to previous analyses, results are indicative of data obtainable from a global solution free of debatable a priori constraints or assumptions about the geopotential. Thus a properly optimized mission using additional information, such as results from altimetry or mean surface anomalies, could improve upon the results presented here. GRA

N80-26988# Kentucky Bureau of Highways, Lexington. Div. of Research.
EVALUATION OF TRIAXIAL TESTING EQUIPMENT AND METHODOLOGIES OF THREE AGENCIES
Tommy C. Hopkins and David L. Allen Dec. 1979 29 p refs (PB80-157654; RR-533) Avail: NTIS HC A03/MF A01 CSCL 08M

The initiation and establishment of a triaxial testing forum whereby any geotechnical laboratory engaged in triaxial testing can check the quality of their triaxial results and therefore evaluate their testing procedures and equipment make-up against the results obtained by other agencies is proposed. Isotropiczlly consolidated, undrained triaxial tests with pore pressure measurements were performed by three agencies on remolded standardized kaolinite specimens in order to initiate the forum. The triaxial results reported by each agency and analyses of all data are reported and show that the three participating agencies obtained about the same results. The forum will be useful to any governmental agency for accrediting any geotechnical laboratory performing work for that agency. GRA

N80-27270*# Arizona Univ., Tucson.
VOLCANO-ICE INTERACTIONS ON THE EARTH AND MARS Ph.D. Thesis
Carlton Carl Allen *In* NASA, Washington Advan. in Planetary Geol. Jun. 1980 p 165-284 refs (For primary document see N80-27268 17-99)
(Grant NGL-03-002-191)
Avail: NTIS HC A14/MF A01 CSCL 03B

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-26990 Iowa State Univ. of Science and Technology, Ames.
PERIODIC VARIABILITY FROM LONG-TERM WEATHER RECORDS Ph.D. Thesis
Robert Stephen Weinbeck 1980 111 p
Avail: Univ. Microfilms Order No. 8012989

Analyses using spectral and superposed epoch methods and empirical orthogonal functions were made of series of 41 state-averaged temperatures and precitation amounts for 1890 to 1977 and 42 selected, area-weighted individual U.S. station values for 1873 to 1977. Cross spectral analyses of these series with sunspot numbers and geomagnetic activity indices also were made. The derived series consisted of areas subject to excesses or deficits from the variable's average defined by the upper and lower 16th percentile limits of the values for the length of record. The temperature and precipitation results are consistent with observed drought patterns in the central Great Plains where drought areas are a maximum following negative to positive transition of the double sunspot cycle. The 21 year periodicity in areas experiencing abnormally high precipitation as defined by their upper 16th percentile years within the record is stronger yet. Dissert. Abstr.

N80-26991 Royal Netherlands Meteorological Inst., De Bilt.
SYNOPTIC AND UPPER AIR OBSERVATIONS IN THE NETHERLANDS, VOLUME 23
1978 397 p In ENGLISH and DUTCH
(KNMI-142-23) Avail: Roy. Netherlands Meteorol. Inst., De Bilt FL 25

Synoptic observations are given for stations in the Netherlands, including lightships and fixed platforms in the North Sea. Summaries of monthly and yearly upper air data are also presented for De Bilt. Station locations, instruments used, and observations made are listed. Author (ESA)

N80-26992*# National Aeronautics and Space Administration. Pasadena Office, Calif.
CLOUD COVER SENSOR Patent Application
Eric G. Laue, inventor (to NASA) (JPL) Filed 27 Jun. 1980 11 p
(Contract NAS7-100)
(NASA-Case-NPO-14836-1; US-Patent-Appl-SN-163837) Avail: NTIS HC A02/MF A01

An apparatus is described which provides a numerical indication of the cloudiness at a particular time of a day. The apparatus includes a frame holding several light sensors such as photovoltaic cells, with a direct sensor mounted to directly face the Sun and indirect sensors mounted to face different portions of the sky not containing the Sun. A light shield guards the direct sensor from most of the sky except a small portion contining the Sun, and also shields each of the indirect sensors from direct sunlight. The relative values of the outputs from the direct and indirect sensors, enables the generation of a numerical indication of the degree of cloudiness at a particular time of day. NASA

N80-26993*# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
APPLICATION OF AN AUTOMATIC CLOUD TRACKING TECHNIQUE TO METEOSAT WATER VAPOR AND INFRARED OBSERVATIONS Final Report, 3 May 1979 - 31 May 1980
Roy M Endlich and Daniel E. Wolf May 1980 32 p refs
(Contract NAS5-25730; SRI Proj. 8600)
(NASA-CR-159995) Avail: NTIS HC A03/MF A01 CSCL 04B

The automatic cloud tracking system was applied to METEOSAT 6.7 micrometers water vapor measurements to learn whether the system can track the motions of water vapor patterns. Data for the midlatitudes, subtropics, and tropics were selected from a sequence of METEOSAT pictures for 25 April 1978. Trackable features in the water vapor patterns were identified using a clustering technique and the features were tracked by two different methods. In flat (low contrast) water vapor fields, the automatic motion computations were not reliable, but in areas where the water vapor fields contained small scale structure (such as in the vicinity of active weather phenomena) the computations were successful. Cloud motions were computed using METEOSAT infrared observations (including tropical convective systems and midlatitude jet stream cirrus). B.D.

N80-26994*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
EVALUATION AND DEVELOPMENT OF SATELLITE INFERENCES OF CONVECTIVE STORM INTENSITY USING COMBINED CASE STUDY ANALYSIS AND THUNDERSTORM MODEL SIMULATIONS Technical Report, 1 May - 30 Apr. 1980
William R. Cotton and Gregory J. Tripoli 30 Jul. 1980 25 p refs
(Grants NsG-5341; NSF ATM-79-08297)
(NASA-CR-163270) Avail: NTIS HC A02/MF A01 CSCL 04B

Major research accomplishments which were achieved during the first year of the grant are summarized. The research concentrated in the following areas: (1) an examination of observational requirements for predicting convective storm development and intensity as suggested by recent numerical experiments; (2) interpretation of recent 3D numerical experiments with regard to the relationship between overshooting tops and surface wind gusts; (3) the development of software for emulating satellite-inferred cloud properties using 3D cloud model predicted data; and (4) the development of a conceptual/semi-quantitative model of eastward propagating, mesoscale convective complexes forming to the lee of the Rocky Mountains. R.E.S.

N80-26996*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AVE-SESAME 2: THE 25-MB SOUNDING DATA
Stephen F. Williams, Myron L. Gerhard, and Robert E. Turner Jun. 1980 377 p refs
(NASA-TM-78281) Avail: NTIS HC A17/MF A01 CSCL 04B

The rawinsonde sounding program for the AVE-SESAME II experiment is described. Data at 25 mb intervals from the surface to 25 mb for the 23 National Weather Service and 19 special stations participating in the experiment are presented. Soundings were taken at 3 hr intervals beginning at 1200 GMT on April 19, 1979, and ending at 1200 GMT on April 20, 1979 (nine sounding times). The method of processing is discussed briefly, estimates of the rms errors in the data presented, an example of contact data given, reasons given for the termination of soundings below 100 mb, and soundings listed which exhibit abnormal characteristics. Author

N80-26998*# City Coll. of the City Univ. of New York.
EIGENVECTOR ANALYSIS OF SOME OBSERVED AND MODEL-GENERATED CLIMATOLOGICAL FIELDS
Michael Dennis Jul. 1980 11 p refs
(Grant NGR-33-013-086)
(NASA-CR-163271) Avail: NTIS HC A02/MF A01 CSCL 04B

An empirical orthogonal function analysis of monthly mean synoptic fields computed with a general circulation model and the corresponding observed climatological patterns is presented. A computer program was used to compute the principal components of the data matrices representing global maps of various observed and model-generated climatological fields. The variables analyzed were: 500mb geopotential height, 850 mb temperature, and sea level pressure. It is concluded that eigenvector analysis of observed and model-generated synoptic climatological fields is a useful diagnostic aid in the evaluation of global model simulation. The maps of any climatological variables are readily decomposed into a few orthogonal components which account for a large fraction of the total spatial variance, and the observed and model-generated patterns may then be compared in terms of these principal components of the original data matrices. R.E.S.

N80-26997*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AVE-SESAME 3: 25-MB SOUNDING DATA
Steven T. Williams, Myron L. Gerhard, Luke P. Gilchrist, and Robert E. Turner Jun. 1980 384 p refs
(NASA-TM-78283) Avail: NTIS HC A17/MF A01 CSCL 04B

The rawinsonde sounding program for the AVE-SESAME 3 experiment is described and tabulated data at 25-mb intervals from the surface to 25 mb for the 23 National Weather Service and 19 special stations participating in the experiment are presented. Soundings were taken at 3 hr intervals beginning at 1200 GMT on April 25, 1979, and ending at 1200 GMT on April 26, 1979 (nine sounding times). The method of processing is discussed briefly, estimates of the rms errors in the data presented, an example of contact data given, reasons given for the termination of soundings below 100 mb, and soundings listed which exhibit abnormal characteristics. A.R.H.

N80-26998*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ICEX: ICE AND CLIMATE EXPERIMENT. REPORT OF SCIENCE AND APPLICATIONS WORKING GROUP
Dec. 1979 152 p refs
(NASA-TM-81028) Avail: NTIS HC A08/MF A01 CSCL 04B

The Ice and Climate Experiment (ICEX), a proposed program of coordinated investigations of the ice and snow masses of the Earth (the 'cryosphere') is described. These investigations are to be carried out with the help of satellite, aircraft, and surface based observations. Measurements derived from the investigations will be applied to an understanding of the role of the cryosphere in the system that determines the Earth's climate, to a better prediction of the responses of the ice and snow to climatic change, to studies of the basic nature of ice forms and ice dynamics, and to the development of operational techniques for assisting such activities in the polar regions as transportation, exploitation of natural resources, and petroleum exploration and production. A high-inclination satellite system with a set of remote-sensing instruments specially tailored to the task of observing the important features of snow, sea ice, and the ice sheets of Greenland and the Antarctic is to be used to record the near-simultaneous observations of multiple geophysical parameters by complementary sensors. J.M.S.

N80-26999*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPLORATORY MEETING ON AIRBORNE DOPPLER LIDAR WIND VELOCITY MEASUREMENTS
George H. Fichtel, ed., John W. Kaufman, ed., and William W. Vaughan, ed. Apr. 1980 57 p refs Meeting held in Huntsville, Ala., 1 Apr. 1980
(NASA-CP-2140) Avail: NTIS HC A04/MF A01 CSCL 04B

The scientific interests and applications of the Airborne Doppler Lidar Wind Velocity Measurement System to severe storms and local weather are discussed. The main areas include convective phenomena, local circulation, atmospheric boundary layer, atmospheric dispersion, and industrial aerodynamics. For individual titles, see N80-27000 through N80-27008.

N80-27000*# Desert Research Inst., Reno, Nev.
AIRBORNE DOPPLER LIDAR WIND MEASURING SYSTEM: APPLICATION TO ATMOSPHERIC PROBLEMS
James W. Telford *In* NASA. Marshall Space Flight Center Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 11-12 (For primary document see N80-26999 17-47)
Avail: NTIS HC A04/MF A01 CSCL 04B

The ability to map velocities over a large area on one side of the aircraft flight path offers a number of opportunities to elucidate scientific questions related to atmospheric dynamics. Several types of experiments which are possible are described. R.E.S.

N80-27001*# Tennessee Univ. Space Inst., Tullahoma. Atmospheric Science Div.
POTENTIAL SCIENTIFIC RESEARCH WHICH WILL BENEFIT FROM AN AIRBORNE DOPPLER LIDAR MEASUREMENT SYSTEM
Walter Frost *In* NASA. Marshall Space Flight Center Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 13-15 (For primary document see N80-26999 17-47)
Avail: NTIS HC A04/MF A01 CSCL 04B

Areas of research which can be significantly aided by the Doppler lidar airborne system are described. The need for systematic development of the airborne Doppler lidar is discussed. The technology development associated with the systematic development of the system will have direct application to satellite systems for which the lidar also promises to be an effective instrument for atmospheric research. R.E.S.

N80-27002*# Texas A&M Univ., College Station. Dept. of Meteorology.
[POTENTIAL USES OF THE AIRBORNE DOPPLER LIDAR WIND VELOCITY MEASUREMENT SYSTEM]
James R. Scoggins *In* NASA. Marshall Space Flight Center Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 16-17 (For primary document see N80-26999 17-47)
Avail: NTIS HC A04/MF A01 CSCL 04B

Four aspects of the Doppler lidar are discussed: (1) error analysis of the system; (2) design of the first field program; (3) potential areas of application; and (4) verification of Doppler lidar data by independent measurements. R.E.S.

N80-27003*# National Science Foundation, Washington, D. C. Atmospheric Sciences Div.
[POTENTIAL APPLICATIONS OF THE DOPPLER LIDAR MEASUREMENTS]
L. Randall Koenig *In* NASA. Marshall Space Flight Center Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 18-19 (For primary document see N80-26999 17-47)

Avail: NTIS HC A04/MF A01 CSCL 04B

The potential application of the Doppler lidar measurements to the determination of material (e.g., water vapor) and energy budgets, momentum transports, etc., in the environment at all stages and in the development of convective clouds are discussed. R.E.S.

N80-27004*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

[MEASUREMENT OF PHENOMENA ASSOCIATED WITH WATER CLOUDS USING DOPPLER LIDAR]

David A. Bowdle *In its* Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 20-24 (For primary document see N80-26999 17-47)

Avail: NTIS HC A04/MF A01 CSCL 04B

Doppler lidar measurements of phenomena associated with water clouds (such as aerosols) are discussed. The purpose of the measurements and details of executing the experiment are described. R.E.S.

N80-27006*# Florida State Univ., Tallahassee. Geophysical Fluid Dynamics Inst.

[APPLICATION OF THE DOPPLER LIDAR SYSTEM TO AGRICULTURAL BURNING AND AIR-SEA INTERACTIONS]

Daniel Fitzjarrald *In* NASA. Marshall Space Flight Center Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 25 (For primary document see N80-26999 17-47)

Avail: NTIS HC A04/MF A01 CSCL 04B

The Doppler lidar system is potentially a very powerful measurement system. Three areas concerning the system are discussed: (1) error analysis of the system to verify the results; (2) application of the system to agricultural burning in California central valley; and (3) oceanographic possibilities of the system. R.E.S.

N80-27006*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

WIND FIELD MEASUREMENT IN THE NONPRECIPITOUS REGIONS SURROUNDING STORMS BY AN AIRBORNE PULSED DOPPLER LIDAR SYSTEM, APPENDIX A

James W. Bilbro and William W. Vaughan *In its* Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 31-39 refs (For primary document see N80-26999 17-47)

Avail: NTIS HC A04/MF A01 CSCL 04B

Coherent Doppler lidar appears to hold great promise in contributing to the basic store of knowledge concerning flow field characteristics in the nonprecipitous regions surrounding severe storms. The Doppler lidar, through its ability to measure clear air returns, augments the conventional Doppler radar system, which is most useful in the precipitous regions of the storm. A brief description of the Doppler lidar severe storm measurement system is provided along with the technique to be used in performing the flow field measurements. The application of the lidar is addressed, and the planned measurement program is outlined. Author

N80-27007*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE MSFC DOPPLER LIDAR SYSTEM, APPENDIX B

James W. Bilbro and Michael C. Krause (Raytheon Co., Wayland, Mass.) *In its* Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 40-42 (For primary document see N80-26999 17-47)

Avail: NTIS HC A04/MF A01 CSCL 04B

The development of pulsed and continuous wave Doppler lidars for atmospheric measurement is discussed. A description of how the lidar systems operate is presented. The scanning mode is also described. R.E.S.

N80-27008*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

POSSIBLE APPLICATIONS OF MSFC DOPPLER LIDAR SYSTEM, APPENDIX C

George H. Fichtel and John W. Kaufman *In its* Exploratory Meeting on Airborne Doppler Lidar Wind Velocity Meas. Apr. 1980 p 43-46 refs (For primary document see N80-26999 17-47)

Avail: NTIS HC A04/MF A01 CSCL 04B

An interpretation of the Doppler lidar return is presented. Possible applications of the system to severe storm research are discussed. The present project schedule of the Doppler lidar system is outlined. R.E.S.

N80-27009# Danish Meteorological Inst., Copenhagen.

ON CLIMATE CHANGES AND RELATED PROBLEMS

Knud Frydendahl, ed. 1978 287 p refs Proceedings of Nordic Symp., Copenhagen, 24-28 Apr. 1978 (DMI-Climatol-Papers-R-4; ISBN-87-7478-154-5) Avail: NTIS HC A13/MF A01

Thirty papers dealing with climate and climatic history are presented. Subjects covered include global paleoclimatic chronology, glacial and arctic climates, climate and history, bioclimatology, and recent events (temperature observations, solar radiation flux density measurements, etc.) as evidence of climatic variations. Results show, in particular the cyclicity of climatic change, arctic responses to climatic fluctuations, the effects of climate on fauna as well as various plants, and the importance of considering climatic variability in formulating meteorological models. For individual titles, see N80-27010 through N80-27039.

N80-27010# Bern Univ. (Switzerland).

FLUCTUATIONS IN THE DURATION OF SNOW COVER IN SWITZERLAND SINCE THE LATE SEVENTEENTH CENTURY

Christian Pfister *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 1-6 refs (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/MF A01

Weather fluctuations towards colder and warmer runs of years, discernable in the last few centuries, are considered in view of how snow was affected by secular climatic change. Records of snowfall, duration of snow cover, and of snow cover occurrence are examined. Problems of interpretation of snow cover chronicles compiled in Switzerland are brought out. Comparison of snow cover observations with pressure maps is made where possible. The impact of climatic fluctuations, especially on the severity of the winter season, is correlated with history for grain and dairy production. Results show that Swiss harvest failures can be attributed to climatic extremes, so far absent from modern weather statistics. Furthermore, as the weather-crop relationships are based on thresholds, climatic change need not be drastic to have a significant impact on crops. Author (ESA)

N80-27011# Danish Meteorological Inst., Copenhagen.

TREE-RING GROWTH AND TEMPERATURE

Alf Braethen *In its* On Climate Changes and Related Probl. 1978 p 7-9 (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/MF A01

The effect of climatic factors on the growth of trees is studied. It is postulated that tree ring observations can be extrapolated to mean day summer temperatures for ten year periods in the past. One thousand one hundred samples from oak (Quercus Robur) which have grown within a radius of about 100 km of a small village north of Gothenburg were measured and investigated. A few hundred of these samples were used to create a chronological reference curve, built up from yearly tree ring growth between A.D. 831 and 1975. A graph of temperature results reflects the figures derived from the prime values, while nothing about their error can be stated. Author (ESA)

N80-27012# Copenhagen Univ. (Denmark). Geographical Inst.

ICE WEDGES AS A GEOMORPHOLOGICAL INDICATOR OF CLIMATIC CHANGES

Harald Svensson *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 9-17 refs (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/MF A01

In the evaluation of climatic changes, quantitative meteorological evidence, biological findings, or glacial fluctuations serve as indicating factors. The possible use of another type of indicator,

directly related to frost processes and indicative of a special climatic situation is discussed. Annual observations on ice wedge growth caused by frost cracking are studied. Based on a mean value for the growth of an ice wedge (the width of the winter crack) and the total width of the wedge, the number of winter cracks can be calculated and thereby the age of the wedge determined. The distinction between active, inactive, and fossil ice wedges is drawn. The use of fossil ice wedges as paleoclimatic indicators is discussed and supportive studies of thermal conditions for recent ice wedge formation to improve this technique are suggested. The use of active ice wedges as potential climatic indicators, supplementary to glaciers, for recording climatic variations in present periglacial or arctic areas is shown.

Author (ESA)

N80-27013# Danish Meteorological Inst., Copenhagen.

CYCLIC CHANGES IN CLIMATE DURING 5,500 YEAR PERIOD REFLECTED IN DANISH RAISED BOGS

Bent Aaby *In its* On Climate Changes and Related Probl. 1978 p 18-26 refs (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/MF A01

A climate investigation based mainly on changes in the degree of decomposition of peat is presented. The study centers on raised bog which are lens shaped, while the peat surface is highest in the central part of the bog. The upper peat layers on the bog do not receive any minerogenic water from their surroundings. Raised bogs therefore have their own water balance with all of the moisture supplied from the atmosphere as rain or snow. The humidity in the upper peat layers layers depends essentially on precipitation, temperature, and evaporation, which makes these bogs very sensitive to variations in climate. The interplay between changes in temperature and precipitation is examined for its effect on peat humification. A statistical test was made to check the significance of the apparent periodicity of humification patterns and also to determine more accurately the length of the period. Results show evidence of a major long term fluctuation in climate with a cyclic periodicity of about 260 years, over the past 5,500 years in northwestern Europe.

Author (ESA)

N80-27014# Lund Univ. (Sweden). Inst. of Economic History.

THE LIMITATIONS OF CLIMATOLOGY AS A FACTOR IN EXPLAINING HUMAN INSTITUTIONS

Gisli Gunnarsson *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 27-34 refs (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/MF A01

Theories of the influence of climatic variations on the development or decline of economic structures throughout history are examined. Numerous references to the connection between climate and the economic troubles of the late Middle Ages are cited. Also mentioned are historical records (1600) from the Faroese Islands concerning fishing, Icelandic historical annals on grain cultivation, and studies on the mystery of the Maya civilization in Mexico. It is concluded that the connection between climate and human activity is often tenuous and that looking for social causes is a more useful approach. Author (ESA)

N80-27015# Danish Meteorological Inst., Copenhagen.

SPECIFICATION IN ETHIOPIAN LEPIDOPTERA INDICATING A CLIMATIC CHANGE

S. J. R. Birket-Smith *In its* On Climate Changes and Related Probl. 1978 p 35-44 refs Sponsored by Natl. Geograph. Soc. (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/MF A01

The compositions of the butterfly faunas in gallery forests and in isolated patches of rain forest in the southern Congo are exactly the same as in the continuous rain forest. This leads to the conclusion that these gallery forests and the isolated patches are the results of a relatively recent regression of the forest in southern Congo. The hypothesis that the present, large numbers of closely related species in many of these rain forest genera are the result of an earlier period of regression of the forest caused by a climatical change is offered and supported by observations. Author (ESA)

N80-27016# Stockholm Univ. (Sweden). Geological Inst.

RECORDED PALEOCLIMATIC CHANGES: CYCLICITY, CORRELATIONS AND RELATION TO CHANGES IN THE ORBITAL GEOMETRY AS WELL AS TO PALEOMAGNETIC AND PALEOGEOID CHANGES

Nil-Axel Moerner *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. Jan. 1978 p 45-52 refs (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/MF A01

Seven major paleoclimatic cycles are identified and discussed. Two cycles are directly related to fluctuations in climate and eustasy, having a periodicity varying between 230 and 1000 years for one, and 1000 to 3600 years for the other. A third cycle with a periodicity of 5250 years depends on cyclic geoid changes. The fourth, fifth, and sixth represent variables in the Earth/Sun constellation, i.e., precession, tilt, and eccentricity. The seventh, controlled by core/mantle changes, consists of a 2.4 million year cyclic change in paleoclimatic amplitude. The seven cycles analyzed range from 100 to 1,000,000 years and seem to be driven by changes in the solar activity, the Earth/Sun constellation, and the core/mantle coupling and interface. The cycles are expressed, directly or indirectly, in many different variables and are influenced by numerous modulating factors. There is a multiple interaction between most geophysical parameters implying that almost any change leads to a variety of secondary effects and feedback mechanisms.

Author (ESA)

N80-27017# Danish Meteorological Inst., Copenhagen.

SOME POINTS OF VIEW ON CHANGES IN THE COMPOSITION OF THE BEETLE FAUNA OF LAKE SHORES IN NORTHERN SCANDINAVIA DUE TO WATER USE REGULATIONS: AN ATTEMPT TO INDICATE THE ALTERATIONS IN PART AS A CONSEQUENCE OF CLIMATIC CHANGES

Axel Friden *In its* On Climate Changes and Related Probl. 1978 p 54-59 refs (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/ MF A01

Ecological problems in Scandinavia, especially those connected with beetle fauna, are discussed. Special attention is given to lake shore areas affected by water use regulation. Results of a census of the beetle population taken twice at a 30 year interval are compared. Some trends in species tolerance to environmental change are noted but no statement on the statistical confidence of data can be made. Water management seems to have little influence on the climate in general. Author (ESA)

N80-27018# Copenhagen Univ. (Denmark). Geographical Inst.

POPULATION AND CLIMATE IN THE DEVELOPMENT OF THE FAROESE PEASANT SOCIETY

Jesper Brandt (Roskilde Univ.) and Rolf Guttsen *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 60-67 refs (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/MF A01

Climate and its decisive influence on the way in which the geographical milieu may be used in the production processes through which a society secures its continuing existence is examined. Population, its size, density, growth, and distribution are seen as another decisive element necessary to understand the conditions under which a society develops. Meteorological data on the Faroe Islands, collected as early as 1781, is reviewed and climatic variations are pointed out. An attempt is then made to relate seasonal trends in the weather to historical social trends in population growth or decline, agricultural, and to the organization of land ownership, trade, and the fishing industry. Results show that although there is evidence of climatic change being at the root of cultural trends, it is not possible to draw a distinct relationship between climate and population due to a lack of empirical evidence. Author (ESA)

N80-27019# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Meteorology.

ON CLIMATIC CHANGES IN FINLAND

Raino Heino *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 68-75 refs Sponsored by Emil Aaltonen Found. (For primary document see N80-27009 17-47)

Avail: NTIS HC A13/MF A01

Areal temperature and precipitation trends in Finland are

described. Observation series are long enough to reveal the climatic developments of the 20th century, but are too short to give a good idea of changes which occured in the 19th. Nonetheless, analysis shows that the main features of temperature and precipitation curves presented correspond fairly well with the picture of global climatic changes. Author (ESA)

N80-27020# Aarhus Univ. (Denmark). Dept. of Palaeoecology.
CLIMATE CHANGE IN THE PALEOZOIC AGE
Nils Spjeldnaes *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 76-84 (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

During the Paleozoic and late Precambrian there were three periods of glaciation; in the latest Precambrian, in the Ordovician, and in the Permo-Carboniferous. All three have peculiarities of areal distribution, sequence, duration, and other aspects which provide some clues as to the mechanics of climatic change. An analysis of these three glaciations is given, together with a review of some of the related biological and geological parameters influencing climatic change, such as the development of the continental albedo (related to the origin of land plants), the oxygen and ozone content of the atmosphere, and the position and movements of the continental plates in relation to the oceanic and atmospheric circulation systems. Author (ESA)

N80-27021# Lund Univ. (Sweden). Dept. of Physical Geography.
THE LATE GLACIAL CLIMATE IN WESTERN SWEDEN
Aake Hillefors *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 85-92 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Landforms in western Sweden are studied. Interstadial land surfaces with periglacial morphological features, such as layers of blown sand, windcutting, and ice wedge casts, covered by fill as well as by glaciofluvial sand are found. Late glacial abrasion by coastal breakers and currents is also investigated. Deglaciation and the dating of isobase surfaces as well as of periglacial features are discussed. Results are used to support conjecture on the climatic conditions necessary to explain apparent rate control of glacial drift. Author (ESA)

N80-27022# Copenhagen Univ. (Denmark). Zoological Inst.
CLIMATE AND DANISH FOREST INSECT PESTS
Broder Bejer-Peterson *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 93-97 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The relation between climate and insect populations is examined. A direct influence of shifts towards a warm, dry climate in Denmark on subsequent mass outbreaks of moths in forest regions is cited. Changing seasonal weather and its effect on jumps in Spruce Aphid and Barkbeetle populations are also shown. In conclusion, closer cooperation in preparing meteorological data by climatologists and zoologists is called for. Author (ESA)

N80-27023# East Anglia Univ., Norwich (England). Climatic Research Unit.
THE VARIETY IN BIOLOGICAL EFFECTS OF CLIMATIC CHANGE
Michael J. Ford *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 98-102 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Climatologists frequently make use of the biological effects of climatic changes in attempting to reconstruct the history of past climates. The considerable variety of such effects which is apparent from responses of the fauna and flora of Britain to the climatic changes that have taken place during the present century is discussed. Studies show that many animals and plants are restricted to specific habitats for essentially climatic reasons. In recent years a number of such species, particularly those restricted to heathland, have become endangered as specialized habitat is reduced due to human population pressure on the environment. Reducing the availability of optimal habitats which are as refuges for plants and animals during unfavorable climatic conditions means that present and future climatic changes can have much more significant effects on the natural fauna and flora, as well as on man himself. Author (ESA)

N80-27024# Copenhagen Univ. (Denmark). Zoological Inst.
CUTWORM ATTACKS IN RELATION TO RAINFALL AND TEMPERATURE DURING A 70 YEAR PERIOD
Ole Zethner and Peter Esbjerg (State Plant Pathol. Inst., Lyngby, Denmark) *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 103-108 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The influence of precipitation and temperature on the occurrence of reported cutworm damage in Denmark is studied in detail. Rainfall and temperature data for the period 1906 to 1976 were considered. Seven years of extreme cutworm damage as compared to nine years of little cutworm damage were identified. The analysis of weather influence is based on a homogeneous evaluation of cutworm attacks by the computer program STAPEL. Results indicate that total May, June, and July precipitation during the year of cutworm infestation is the most important factor in evaluating the risk of crop damage. Author (ESA)

N80-27025# Risoe National Lab., Roskilde (Denmark). Meteorology Section.
STOCHASTIC MODEL BUILDING FOR DISCRETE TIME SERIES APPLIED ON A PALEOTEMPERATURE SERIES FROM THE LAST 700,000 YEARS
Erik Lundtang Petersen and Soeren E. Larsen *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 109-113 refs Repr. from 5th Conf. on Probability and Statistics, Preprint Vol., Nov. 1977 (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

A time series is shown which displays an indicator of the temperature variations in the Northern Hemisphere over the last 700,000 years. Methods from stochastic forecast and control theory are applied to model this time series in terms of linear stochastic models. The model constructed are then used to forecast future behavior of the series. The different model predictions are compared. Results show that for model building the series presented has the disadvantage of including variations of many time scales. The longest (90,000 years) is so long compared to the series length that it difficult to represent it in any statistically reliable way. However, for the immediate future (5,000 to 15,000 years) all models agree in their forecasts, indicating a coming global cooling over the scales considered. Author (ESA)

N80-27026# Copenhagen Univ. (Denmark). Zoological Inst.
APHID FLIGHT ACTIVITY AFFECTED BY WIND FACTORS AND OTHER CLIMATIC CONDITIONS
Holger Philipsen *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 114-115 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

A suction trap network for catching small flying insects and covering parts of Great Britain, Holland, and Denmark is described. One trap in Denmark used to study aphids, was emptied once an hour in order to measure the effect of climatic conditions on flight activity with particular emphasis on the influence of wind factors. For this purpose wind speed as well as wind direction were registered. The trappings often lead to the characteristic bimodal activity-curve, but cases with one peak or no peaks at all are frequent. Some of these cases can be explained by extreme, high wind speeds preventing aphid flight. On several occasions, pronounced peaks in flight activity appear at the same time as changes in wind direction. No simple connection between single climatic factors and flight activity can be expected, but the findings indicate that changing wind direction can be an additional and stimulating factor for aphid flight, presupposing that no other factors cause limitation. Author (ESA)

N80-27027# East Anglia Univ., Norwich (England). Climatic Research Unit.
THE VARIABILITY OF CLIMATE: OBSERVATION AND UNDERSTANDING
H. H. Lamb *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 116-144 refs (For primary document

see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The changing perception of, and attitudes toward, climatic variation during the development of meteorological science and the importance of climatology at the present day are reviewed. What is now known of the magnitudes, rapidity, and the geographical as well as timewise distributions of climatic fluctuations and changes are examined. Subjects touched on include the construction of longer records of climate, analysis of climatic records, and the prediction of future trends. Conclusions are related to a global cooling trend in atmospheric temperature. Author (ESA)

N80-27028# Danish Meteorological Inst., Copenhagen.
AN APPROACH TO THE UNDERSTANDING OF THE SUMMER CLIMATE 7,000 TO 6,000 BEFORE PRESENT IN RYFYLKE, SOUTHWEST NORWAY
Lotte Selsing and Erik Wishman *In its* On Climate Changes and Related Probl. 1978 p 145-153 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Archaeological findings reveal that a mesolithic hunting culture utilized the Ryfylke mountain areas around the 1000 m level only during the period 7,000 to 6,000 before present. An attempt is made to related these findings to changes in the natural environment during the period. The pine forest in this area was studied. Observations show that the forest reached its highest level between 7,000 and 6,000 years before present and that it differs from the present limit by nearly 200 m. The east-west inclination of the average pine forest limit was about the same 7,000 to 6,000 years ago as it is today (i.e., around 5 m/km). These data are interpreted in order to derive a mean summer temperature for the area during the time when the mean pine forest limit was situated at its highest (Atlantic period). The temperature estimate is used to determine reasonable circulation patterns which could have dominated the area during the summer season for the period discussed. Author (ESA)

N80-27029# Danish Meteorological Inst., Copenhagen.
ARCTIC CLIMATE AND ECOLOGICAL CHANGES, THE SPRING-TIDES, AND THE DECLINATION OF THE SUN
Christian Vibe *In its* On Climate changes and Related Probl. 1978 p 154-161 (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The coincidence between fluctuations in arctic climate and rhythmic fluctuations in animal populations is investigated. Studies of arctic herbivorous mammals, sea mammals, and sea birds, in conjunction with data on drift ice and the seasonal occurrence of maximum tides in the Arctic ocean, are cited. The periodicity of fluctuations in the numbers of animals, such as the Greenland whale, the caribou, the hare, the lynx, the polar bear, and the arctic fox, is shown. Simultaneously, a periodic influx of deep Atlantic water to the surface of the Arctic ocean is found. Author (ESA)

N80-27030# Copenhagen Univ. (Denmark). Inst. of Historical Geology and Palaeontology.
OXYGEN ISOTOPE PALEOTEMPERATURES FROM THE TERTIARY NORTH SEA: EVIDENCE OF A 30 MILLION YEAR CLIMATIC PERIODICITY
Bjoern Buchardt *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 162-167 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The climatic development of northwestern Europe during the last 65 megayears, the Tertiary period, which includes the important shift from the overall warm global climates to the glacian extremes that have characterized the last million years, is considered. The climatic history of periods older than those known from written information are studied by indirect methods. Studies of the changing character of floras and faunas in the European Tertiary deposits reveal that climatic fluctuations did take place during this period. Data based on oxygen isotope measurements about variations in the water temperature of the Tertiary North Sea are evaluated, while the influence of probable global climatic oscillations on these variations is assessed. Data from Upper Cretaceous (80 to 65 megayears old) deposits in Europe indicate higher northwestern European temperatures when compared to the Middle Paleocene (60 megayears ago) values obtained. A second climatic minimum about 30 megayears ago is also identified. The temporal spacing of the observed minima suggests the existence of a 30 megayear climatic cyclicity during the Tertiary and Quarternary periods. Author (ESA)

N80-27031# Danish Meteorological Inst., Copenhagen.
WATER RESOURCE PLANNING AND CLIMATIC CHANGES
Richard Thomsen *In its* On Climate Changes and Related Probl. 1978 p 168-174 ref (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Research into possible water resources and their potential to meet demand, especially in the agricultural sector, was carried out on the Island of Samsoe, Denmark. Present and future water supply demand, along with the quantity and quality of ground water resources available, were assessed. The limits for extended use of ground water without permanent damage to the aquifers were considered. Results show the importance of the climatic factor in determining ground water replacement through the percolation of precipitation. Author (ESA)

N80-27032# Danish Meteorological Inst., Copenhagen.
HOLOCENE (10,000 YEARS AGO TO PRESENT) CLIMATES IN GREENLAND AND NORTH ATLANTIC ATMOSPHERIC CIRCULATION
Svend Funder (Geologisk Museum, Copenhagen) *In its* On Climate Changes and Related Probl. 1978 p 175-180 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Ten thousand years ago the margins of the Greenland Inland ice were shrinking rapidly, while plants and animals migrated into the newly exposed land areas and coastal waters. The records for these organisms and for the retreat of the ice margin were worked out by pollen analysis of lake sediment, investigations of the faunas of isostatically raised marine deposits, and mapping of moraine systems; they have all been dated by carbon 14. An investigation and comparison of these records are made. The correlation is not particularly good, especially when low arctic west Greenland is compared to high arctic east Greenland. Differences in the climatic development as a likely cause for some of the lack of correlation is suggested. As a working hypothesis it is supposed that the differences may be explained by changing atmospheric circulation over the North Atlantic. Author (ESA)

N80-27033# East Anglia Univ., Norwich (England). Climatic Research Unit.
TOWARDS AN UNDERSTANDING OF CLIMATIC CHANGE: ITS IMPACT IN HISTORY AND IN THE MODERN WORLD
H. H. Lamb *In* Danish Meteorol. Inst. On Climate Changes and Related Probl. 1978 p 181-204 ref (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The influence of climatic change on the development of civilization is stressed. Different records, such as actual meteorological reports of the weather observed, of fossil records which register the effects of past weather and climate, are considered. Results allow for the identification of cyclic changes in global climate. These fluctuations are used to postulate a forecasting scheme. To emphasize the need for a better understanding of climatic variations, various natural disasters involving widespread human suffering are cited from history. Author (ESA)

N80-27034# Danish Meteorological Inst., Copenhagen.
FLUCTUATIONS IN THE TEMPERATURE OF THE SURFACE WATER IN AREAS OF THE NORTHERN NORTH ATLANTIC, 1876 TO 1975
Jens Smed (Intern. Council for the Exploration of the Sea) *In its* On Climate Changes and Related Probl. 1978 p 205-210 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Regular observations of the sea surface temperature made either on board ships or at coastal weather stations in the north Atlantic Ocean are reported. Temperature data analysis is discussed and monthly means are found. Temperature anomalies for 1 deg squares both monthly and yearly, are then derived

and weighted according to the density of measurements. Surface water temperature trends over the period are shown.
Author (ESA)

N80-27035# Danish Meteorological Inst., Copenhagen.
VARIATION OF CLIMATE, AS INDICATED BY EXTENDED TEMPERATURE RECORDS FROM DENMARK, THE FAROES AND GREENLAND: A SHORT REVIEW OF SUN-WEATHER RELATIONSHIPS
Niels Weetmann *In its* On Climate Changes and Related Probl. 1978 p 212-222 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The possible influence of solar activity cycles on climatic variations is examined. It is noted that an unusually cold period in Europe from the 18th century through the early 19th century corresponds almost exactly with a period in the history of the Sun with exceptionally few sunspot observations. Next, atmospheric temperature records, consisting of monthly mean temperatures and dating from as early as 1792, are studied. The temperature records were filtered by applying a 20 year moving average. Results are shown graphically, then used to identify cooling or warming seasonal trends. Author (ESA)

N80-27036# Danish Meteorological Inst., Copenhagen.
INCREASE IN SOLAR RADIATION ABOUT 1915
Knud Frydendahl *In its* On Climate Changes and Related Probl. 1978 p 224-234 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The differences between astronomical sunrise and start of the burnt track on a Campbell-Stokes heliograph, as well as the differences between sunset and the end of the track, were measured. To diminish the errors from skew mountings of the cards, the sum of these differences (at dawn and sunset) was taken as a measure of how good radiation conditions were on each single day. For each month, the day with the smallest sum of differences (i.e. the day optimal for solar radiation at dawn and sunset) was chosen. results show that about 1915 the solar intensity at the surface of the earth increased all over the world. It is also found that there is a probable correlation between climatic changes and this increase in the solar constant. Author (ESA)

N80-27037# Danish Meteorological Inst., Copenhagen.
SEA SURFACE TEMPERATURES IN THE NORTH ATLANTIC 1957 TO 1976
G. Stougaard-Nielsen *In its* On Climate Changes and Related Probl. 1978 p 235-242 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

Sea surface temperatures for each 1 deg square in the area 50 deg to 80 deg N, 0 deg to 60 deg W were extracted from meteorological log books kept by since 1895. The reports are, stored on magnetic tape at regional centers according to the rules of CMM/WMO. With 20 year of observations stored, a subarea was chosen along the main route between Denmark and Greenland so that the distribution of observations was reasonably close. During most years, no sea ice occurred inside the region. The whole region was divided into 18 areas. Each area covers 4 deg of latitude and 4 deg of longitude, and has a number composed of the latitude and the longitude of the central point. Several tables of mean temperature trends were calculated and a few of them are shown. The mean temperatures for the years 1957 to 1976 and those for the years 1876 to 1915 are compared. Author (ESA)

N80-27038# Danish Meteorological Inst., Copenhagen.
WHAT HISTORIANS KNOW ABOUT THE CLIMATE IN DENMARK DURING THE MIDDLE AGES
Svend Gissel *In its* On Climate Changes and Related Probl. 1978 p 249-250 (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

An abstract of a study made on the possible correlation between climatic variations and historical events in Denmark is presented. Emphasis is on the desertion of villages and eventual recolonization, or in some cases new colonization, as recorded in annals or as evidenced from archeological investigations. Pollen studies made by analyzing high bogs are also cited to corroborate the dating of climatic changes. Results show some relation between climatic deterioration and history, however, coincidence cannot be ruled out. Author (ESA)

N80-27039# Danish Meteorological Inst., Copenhagen.
AN INTRODUCTION TO STATISTICAL METHODS
Peter Nimmo Allerup *In its* On Climate Changes and Related Probl. 1978 p 252-260 refs (For primary document see N80-27009 17-47)
Avail: NTIS HC A13/MF A01

The use of statistical models and statistical methods, especially the manipulation of mathematical formulas is discussed in terms of coming to grips with the complexity of natural phenomena. Normal distribution (in the movements of a pendulum as an example), time series analysis, the specification of accuracy, and the identification of data structures are considered. The possibilities for enlarging the scope of statistical analyses in research work is discussed. Author (ESA)

N80-27040# Air Force Global Weather Central, Offutt AFB, Nebraska.
THE AFGWC AUTOMATED ANALYSIS/FORECAST MODEL SYSTEM
Terry C. Tarbell and James E. Hoke Dec. 1979 60 p refs (AD-A083157; AFGWC/TN-79/004) Avail: NTIS HC A04/MF A01 CSCL 04/2

This technical note (TN) describes the automated analysis/forecast model system that currently exists at the Air Force Global Weather Central (AFGWC). The emphasis will be on the interrelation and cycling of the various analysis/forecast models in the production cycle. This description of the automated analysis/forecast system was written for managers, programmers, computer operations personnel, users of the ultimate products, and the meteorological community at large. This TN will only address analysis/forecast models that are the primary meteorological data-base builders. Most applications programs that access the data bases are therefore not included. GRA

N80-27041# Air Force Global Weather Central, Offutt AFB, Nebraska.
TRAINING GUIDE FOR SEVERE WEATHER FORECASTERS
Charlie A. Crisp Nov. 1979 82 p refs (AD-A083125; AFGWC/TN-79/002) Avail: NTIS HC A05/MF A01 CSCL 04/2

Presented here is a formal and detailed training guide designed for a forecaster's initial exposure to the Air Force Global Weather Central's (AFGWC) severe weather function. This TN details the analysis procedures for all charts and prognostic tools available to the severe weather function. Significant severe weather parameters are analyzed at the surface 850 mb, 700 mb, and 500 mb levels. Additionally, the 850/500 mb thickness and maximum wind charts are examined. Also discussed are the severe weather parameters chart and the 12-hour surface pressure change chart. A detailed, step-by-step evaluation of a synoptic situation is presented along with appropriate forecasts and verification data. Finally, the automated prognoses available at AFGWC are discussed in relation to severe weather forecasting. Prior to using this guide, forecasters should become familiar with AWSTR 200 (Rev), 'Note on Analysis and Severe Storm Forecasting of the Air Force Global Weather Central'. AWSTR 200 (Rev) is referred to briefly when relating analyzed parameters to those synoptic patterns producing severe thunderstorms and tornadoes. This TN will familiarize field users with the techniques used to produce the Military Weather Advisory (MWA). GRA

N80-27042# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL WIND FIELD MODEL VALIDATION IN COMPLEX TERRAIN WITH APPLICATION TO POLLUTANT TRANSPORT
William M. Porch Mar. 1980 7 p refs Presented at 2nd Joint Conf. on Applications of Air Pollution Meteorology, New Orleans, 24-27 Mar. 1980 Submitted for publication (Contract W-7405-eng-48)
(UCRL-83269; CONF-800327-3) Avail: NTIS HC A02/MF A01

The interaction of meteorological data taken at points in a region with numerical models can be done smoothly in gently varying terrain. However, it is fraught with difficulties in complex terrain. Computer memory size limits the resolution of the topography and a point measurement becomes representative of smaller scales as the topography becomes more complex. This paper describes how remotely sensed spatially averaged winds from optical anemometers can be used to help the interaction of wind measurements made at points within a region and numerical regional wind field models. Emphasis is placed on model validation both as wind field estimates for applications such as wind energy prospecting and as input to pollutant dispersion models. DOE

N80-27043# Battelle Pacific Northwest Labs., Richland, Wash.
SIMULATION OF ATMOSPHERIC TURBULENCE
W. C. Cliff and D. L. Hall Jan. 1980 29 p refs
(Contract EY-76-C-06-1830)
(PNL-3276) Avail: NTIS HC A03/MF A01

A method is described for constructing an artificial temporal sequence of velocity values for simulating atmospheric turbulence. The method develops the conditional probability density distribution of velocity given that the previous value of velocity is known. A value is randomly selected from the conditional probability density which then serves as a known value for the next conditional probability density function. Continuing this procedure provides the desired simulated sequence of velocity values. Based upon this simulation method a program is developed for a hand-held calculator for simulating the longitudinal component of atmospheric turbulence during neutral or strong wind conditions. DOE

N80-27044# Sandia Labs., Albuquerque, N. Mex. Environmental Research Div.
APPLICATION OF WIND DATA TOWARD REVISION OF THE ANSI WIND LOADS STANDARD
Hugh W. Church 1980 10 p refs Presented at 2nd Joint Conf. on Applications of Air Pollution Meteorology, New Orleans, 24 Mar. 1980
(Contract EY-76-C-04-0789)
(SAND-79-1973C; CONF-800327-1) Avail: NTIS HC A02/MF A01

The American National Standards Institute provides the machinery for creating voluntary standards, which represent general agreement among maker, seller, and user. The ANSI A58.1 standard: Building Code Requirements for Minimum Design Loads in Buildings and Other Structures, last revised in 1972, is currently undergoing the consensus phase toward its scheduled 1980 revision and publication. This standard is intended to provide minimum load requirements for the design of building code requirements. The A58 Windloads Subcommittee has produced an updated national map of annual probable extreme wind speeds to be used in assessing wind loads on structures. After a brief review of previous wind map versions, data selection criteria establishment and collection, data homogenization and reduction, statistical analysis, extreme wind field map analysis, and treatment of special regions are discussed. Finally, some of the data problem areas are discussed with some suggestions offered for their improvement. DOE

N80-27045# Royal Netherlands Meteorological Inst., De Bilt.
PRECIPITATION, 1978
1979 125 p In ENGLISH and DUTCH
(KNMI-117-79) Avail: NTIS HC A06/MF A01; Roy. Netherlands Meteorol. Inst., De Bilt FL 10

Daily precipitation data for the Netherlands during 1978 are listed by station. Averages were computed, and monthly and yearly summaries shown for each station. A map gives the location of each rain gauge. Author (ESA)

N80-27046# Royal Netherlands Meteorological Inst., De Bilt.
A VERTICALLY DETAILED ANALYSIS OF SOME AIR MASS PROPERTIES
G. J. Cats and J. Reiff 1979 21 p refs
(KNMI-V-329) Avail: NTIS HC A02/MF A01

A method for obtaining a detailed analysis of air mass properties such as temperature and humidity for use in isentropic trajectory models is described. The temperature and humidity of the advected air mass are analyzed as linear combinations of observed temperatures (respectively humidities) at nearby stations. The weights are taken proportional to the inverse of the square of the distance between air mass source and observation point. Since only at some levels the air mass source is known (namely at the trajectory levels), the weights are linearly interpolated between those levels. Some analysis examples are given. Author (ESA)

N80-27047# Royal Netherlands Meteorological Inst., De Bilt. Bureau Vakopleidingen.
WIND MAXIMA IN THE UPPER BOUNDARY LAYER, WINTER 1978-1979 [WINDMAXIMA AAN DE BOVENZIJDE VAN DE GRENSLAG GEDURENDE DE WINTER VAN 1978-1979]
C. J. vanderHam 1980 33 p refs In DUTCH
(KNMI-V-336) Avail: NTIS HC A03/MF A01

A synoptic study of low level wind maxima was made for nocturnal, frontal and non frontal cases. Situations with glazed frost fronts seemed to favor the occurrance of maxima. Maxima were also frequent in situations with east winds in a shallow cold boundary layer. In a few cases, sea influences played a role. Author (ESA)

N80-27048# Royal Netherlands Meteorological Inst., De Bilt.
A CONVERGENCE ANALYSIS OF A NUMERICAL METHOD FOR SOLVING THE BALANCE EQUATION
S. J. Bijlsma and R. J. Hoogendoorn 1980 18 p refs
(KNMI-WR-80-1) Avail: NTIS HC A02/MF A01

The convergence of an iterative method for solving the nonlinear balance is analyzed. It is shown that this iterative method will be convergent if sufficiently accurate initial approximation is used and if the subsequent iterates satisfy the ellipticity condition. Otherwise if the successive approximate solutions do not all satisfy the ellipticity condition the method may be divergent. Measures to make the method convergent in this case are described. Experimental results are given. Author (ESA)

N80-27049# Resource Analysis, Inc., Waltham, Mass.
MEAN SQUARE ERROR ESTIMATION COMPUTER PACKAGE USER'S MANUAL
Guillermo J. Vivens, Donald S. Grossman, R. R. Evans, and D. Leighton Sep. 1979 80 p
(Contract NBS-7-35111)
(PB80-150808; NOAA-80010202) Avail: NTIS HC A05/MF A01 CSCL 04B

The mean square error estimation (MSEE) computer package is described. The MSEE package is a computerized methodology for evaluating the accuracy of a rainfall measurement network. GRA

N80-27050# National Weather Service, Salt Lake City, Utah.
THE BART EXPERIMENT
Morris S. Webb, Jr. Oct. 1979 45 p refs
(PB80-155112; NOAA-TM-NWS-WR-146; NOAA-80010904)
Avail: NTIS HC A03/MF A01 CSCL 04B

The BART (Bay Area Regional Temperature) Experiment attempts to objectively forecast temperatures at seven locales in the San Francisco Bay Area by statistical means. The method of least squares and a type of screening regression were used to create sets of seasonal forecast equations. Forecasts of daily maximum and minimum temperature at seven stations in northern and central California that are forecast points for the Model Output Statistics technique plus the date/time group of the forecast serve as predictors for the BART equations. Appendices containing FORTRAN IV programs developed during the experiment and the procedure which obtains the temperature forecasts are also presented. GRA

N80-27051# Texas A&M Univ., College Station. Dept. of Meteorology.
TEXAS HIPLEX MESOSCALE EXPERIMENT: SUMMER 1979 DATA TABULATIONS
Steven F. Williams, Myron L. Gerhard, and James R. Scoggins Jan. 1980 721 p refs
(Contract DI-14-06-D-7587)
(PB80-153034; LP-118) Avail: NTIS HC A99/MF A01 CSCL 04B

A mesoscale experiment was conducted in the High Plains

of west Texas during the summer of 1979 as part of the High Plains Cooperative Program. Data are presented for five special (manual) surface stations and seven rawinsonde stations. The surface data consist of five minute averages of temperature, relative humidity and pressure for each hour on the hour for the period June 20 through July 20, 1979. Rawinsonde data are presented at 25 millibar intervals for 23 operational days during the period May 21 through July 18, 1979. Radar observed convective activity taken from Midland NWS radar data is presented for each day during the period May 21 through July 19, 1979. GRA

N80-27052# National Weather Service, Salt Lake City, Utah.
A REAL-TIME RADAR INTERFACE FOR AFOS
Mark Mathewson Jan. 1980 100 p
(PB80-151605; NOAA-TM-NWS-WR-148; NOAA-80021501)
Avail: NTIS HC A05/MF A01 CSCL 04B

Real time radar data is very important in flash flood and severe thunderstorm situations. The software interface between a WSR 74C weather radar and AFOS is described. By using a Nova 312 minicomputer as the interface device, real time displays can be made available to forecasters on AFOS. The hardware interface between the WSR 74C radar and Nova 312 has been described in detail. Schematics and waveform diagrams have been included. The software description is also supplemented by flowcharts and tables. The appendix contains program listings, MDB interface board descriptions and schematics, and examples of AFOS-radar output. GRA

N80-27053# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
PROJECT SEVERE ENVIRONMENTAL STORMS AND MESOSCALE EXPERIMENT: SESAME 1979 FIELD-PROCESSED RAWINSONDE DATA FROM SUPPLEMENTARY SITES, 10 APRIL - 8 JUNE
Stanley L. Barnes Oct. 1979 261 p refs
(PB80-156219; NOAA-80010903) Avail: NTIS
HC A12/MF A01 CSCL 04B

The field data reduced soundings from the supplementary stations are presented to allow investigators a preliminary view of the meteorological conditions associated with the various experiments. Between April 10 and June 8, 1979, there were 21 days of SESAME upper air operations. The soundings are given in the unchecked form in the report. GRA

N80-27054# Utah Water Research Lab., Logan.
USE OF EXTREME VALUE THEORY IN ESTIMATING FLOOD PEAKS FROM MIXED POPULATIONS
R. V. Canfield, D. R. Olsen, R. H. Hawkins, and T. L. Chen Feb. 1980 47 p refs
(Contract DI-14-43-0001-9100)
(PB80-161052; UWRL/H-80/01; W80-04015; OWRT-B-173-UTAH-1) Avail: NTIS HC A03/MF A01 CSCL 04B

The problem encountered when empirical fit alone is used to select a best distribution is presented along with the application of extreme value theory to stream flows which have homogeneous sources. The results clearly demonstrate the usefulness of extreme value theory. The extreme value theory is extended to the case in which the events in the annual series are random variables from two different populations (e.g., thunderstorm and cyclonic events). The mechanics of applying these results in flood frequency analysis are discussed. GRA

N80-27055# Chicago Univ., Ill. Dept. of Geophysical Sciences.
RAWINSONDE DETECTION OF STRATOSPHERIC MOISTURE IN THE VICINITY OF THUNDERSTORM TOPS
Peter D. McGurk Jun. 1979 22 p refs
(Grant NOAA-04-4-158-1)
(PB80-161458; SMRP-RP-176; NOAA-80021226) Avail: NTIS HC A02/MF A01 CSCL 04B

Approximately 200 soundings were taken at Yorkville, Illinois for project NIMROD. Many of these ascents were tracked well into the lower stratosphere to their burst and descent back into the troposphere. Soundings taken during a severe thunderstorm over northern Illinois, detected humidity in the stratosphere a few kilometers above the storm top. The location of the radiosondes in relation to the thunderstorms was determined by using a sequence of satellite pictures. The overshooting and collapsing processes atop severe thunderstorms are suggested as a mechanism for the moisture transport. GRA

N80-27056# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.
MARINERS WEATHER LOG, VOLUME 23, NO. 1
Elwyn Wilson, E., ed. Jan. 1980 85 p Sponsored by NOAA
(PB80-161193; NOAA-80021104) Avail: NTIS
HC A05/MF A01 CSCL 04B

Regular sections include: Hints to the observer; Tips to the radio officer; Hurricane alley; On the editor's desk; Marine weather review and Marine weather diary. In addition this issue includes the following articles: Drift of the VENOIL in the Agulhas Current; Typhoon Hope, August 1979; Tropical storms Mac and Nancy; and High waves in the Benguela Current. GRA

N80-27057# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE, NO. 7. SUMMARY REPORT 1978
Bernard G. Mendonca Dec. 1978 138 p refs
(PB80-165962; NOAA-80030505) Avail: NTIS
HC A07/MF A01 CSCL 04B

A remote sensing technique to measure vertical ozone profiles by incorporating more Dobson wavelengths in the measurements was refined and evaluated against the older Umkehr method. A procedure to correct the ozone profiles for perturbations in stratospheric aerosol concentrations is described. Two solar irradiance studies that measure urban effects on incoming radiant energy were completed. Twenty-seven summary reports from cooperative programs are given. Investigations of aerosol chemistry at Barrow and the South Pole were the major efforts of the cooperative programs for 1978. GRA

N80-27058# National Center for Atmospheric Research, Boulder, Colo. Convective Storms Div.
NATIONAL HAIL RESEARCH EXPERIMENT DATA CATALOG, 1972 - 1976 Final Report
Dec. 1979 265 p
(Grant NSF ATM-77-23757)
(PB80-160419; NCAR-TN-148) Avail: NTIS
HC A12/MF A01 CSCL 04B

The observational systems and networks involved in a hail research experiment are described and summaries of selected daily research activities are given. Instrument development and data quality and availability are also discussed. GRA

N80-27059# Interior Dept., Denver, Colo. Water and Power Resources Service.
SIERRA COOPERATION PILOT PROJECT. DATA INVENTORY, 1978 - 1979
Jul. 1979 146 p
(PB80-144934) Avail: NTIS HC A07/MF A01 CSCL 04B

An inventory of all data that were collected from November 1978 to April 1979 in association with the Sierra Cooperative Pilot Project, a weather modification research project in winter orographic cloud seeding is presented. Forecasting, radar, satellite, aircraft, rawinsondes, precipitation gage network, other surface observations, ice nucleus and seeding tracer detection system, ground microphysics, snow profiles, cooperative and operational seeding activities, and National Weather Service are among the topics covered. GRA

N80-27060# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
A COMPARISON OF THEORETICAL AND OBSERVED RADIANCES FROM NON-PRECIPITATING CUMULUS CLOUDS
Mark DeMaria and Thomas McKee May 1979 97 p refs
(Grant NSF ATM-76-80568)
(PB80-150923; AS-PAPER-313; ISSN-0067-0340) Avail: NTIS HC A05/MF A01 CSCL 04A

Relative radiances from a theoretical model for the scattering of solar radiation by finite clouds were compared to observed radiances from the sides of nonprecipitating cumulus clouds. The

sides of five cumulus clouds ranging from 1 to 3 km in depth, with width to depth ratios of about 1.5 were scanned with an aircraft mounted radiometer sensitive in the spectral range of 0.65 to 0.95 micrometers. Photographs of each cloud were taken just before each scan with a camera optically aligned with the radiometer. GRA

N80-26363*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A SURVEY OF NUMERICAL MODELS FOR WIND PREDICTION
D. Schonfeld *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 151-170 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-27061# Skidaway Inst. of Oceanography, Savannah, Ga.
CONTINENTAL SHELF PROCESSES AFFECTING THE OCEANOGRAPHY OF THE SOUTH ATLANTIC BIGHT Progress Report, Jun. 1979 - 31 May 1980
L. P. Atkinson 29 Feb. 1980 9 p
(Contract DE-AS09-76EV-00889)
(DOE/EV/00889-6) Avail: NTIS HC A02/MF A01

Progress is reported on research conducted on various oceanographic aspects of the South Atlantic Bight. Research topics includes: (1) a flushing model of Onslow Bay, North Carolina based on intrusion volumes; (2) a description of a bottom intrusion in Onslow Bay, North Carolina; (3) detailed observations of a Gulf Stream spinoff eddy on the Georgia continental shelf; (4) Pelagic tar of Georgia and Florida; (5) a surface diaton bloom in response to eddy forced upwelling; and (6) hydrographic observations off Savannah and Brunswick, Georgia. DOE

N80-27062# Columbia Univ., Palisades, N.Y. Lamont-Doherty Geological Observatory.
TRANSPORT AND TRANSFER RATES IN THE WATERS OF THE CONTINENTAL SHELF Annual Report
P. E. Biscaye, Arnold L. Gordon, Yuan-Hui Li, and Thomas C. Malone Aug. 1979 160 p refs
(Contract EY-76-S-02-2185)
(COO-2185-12) Avail: NTIS HC A08/MF A01

Two cruises designed to expand the sample base, measure the time variability of several transfer processes, and to test specific hypotheses on the mechanisms for processes which effect exchange of continental margin with open ocean waters were carried out. Progress was made in understanding the relative roles of nutrients and light in controlling the productivity of important primary biomass. Progress was also made in understanding the influences of phytoplankton populations on distribution of inorganic nutrients, dissolved oxygen and particulate organic matter. Radionuclides were studied in water columns and in sediments to develop an understanding of processes associated with suspended solids and with sediments as sinks for radionuclides and other pollutants. Major progress was made on the analysis of hydrographic data from all previous cruises and to evolve a comprehensive picture of the stratification of the waters of the New York Bight. The CO2-H2O equilibration system required for the preparation of samples for oxygen isotope analysis was completed. DOE

N80-27063# Woods Hole Oceanographic Institution, Mass.
OBSERVATIONS OF LONG PERIOD WAVES IN THE TROPICAL OCEANS AND ATMOSPHERE Ph.D. Thesis - MIT
Douglas S. Luther Feb. 1980 215 p refs
(Grant NSF OCE-73-01384)
(PB80-158843; WHOI-80-17) Avail: NTIS HC A10/MF A01 CSCL 08C

The existence of resonant, baroclinic, equatorially trapped, inertia gravity waves is confirmed in the mid Pacific by spectral analysis of long sea level records. The energy of the low mode inertia gravity waves is found to decrease toward the meridional boundaries. A simple spectral model, acknowledging the dispersive characteristics of the equatorial waves, adequately reproduces the observed mid Pacific sea level spectra in the 1 to 6 day band. Model spectra computed at latitudes outside the equatorial waveguide of the gravest meridional modes suggest the presence of 'inertial' peaks in several observed sea level spectra. Resonant, low mode inertia gravity waves may also exist in the Indian Ocean. GRA

N80-27064# Environmental Research and Technology, Inc., Concord, Mass.
SUMMARY AND ANALYSIS OF PHYSICAL OCEANOGRAPHIC AND METEOROLOGICAL INFORMATION ON THE CONTINENTAL SHELF AND BLAKE PLATFORM FROM CAPE HATTERAS TO CAPE CANAVERAL. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jul. 1979 32 p
(Contract DI-AA550-CT-7-16)
(PB80-159072; ERT-2904-Vol-1; BLM/YM/ES-79/20) Avail: NTIS HC A03/MF A01 CSCL 08C

The synthesis and analysis of the physical oceanographic and meteorological data on the continental shelf and Blake Plateau from Cape Hatteras to Cape Canaveral is presented. Numerous information sources were searched to obtain an analysis of the climatology, wave data, hydrography, and the circulation of the continental shelf waters, which are crucial to platform construction, safety procedures, and management decisions. Seasonal variances of air temperature, wind speed and wind direction, cloud cover, cloud ceilings, visibility, precipitation, storms, weather fronts, solar radiation, and precipitation runoff are discussed and summarized. GRA

N80-27065# Environmental Research and Technology, Inc., Concord, Mass.
SUMMARY AND ANALYSIS OF PHYSICAL OCEANOGRAPHIC AND METEOROLOGICAL INFORMATION ON THE CONTINENTAL SHELF AND BLAKE PLATEAU FROM CAPE HATTERAS TO CAPE CANAVERAL. VOLUME 2, SECTIONS 1 - 5 Final Report, 1977
Jul. 1979 393 p refs
(Contract DI-AA550-CT-7-16)
(PB80-159080; ERT-P-2904-Vol-2; BLM/YM/ES-79/21) Avail: NTIS HC A17/MF A01 CSCL 08C

The data sources contacted for potential data, how the data were screened, and the final sets of data used to assess the environmental effects of offshore oil and gas development are described. Procedures for future data identification and assembly efforts are recommended. A wide range of meteorological and climatological data are presented and discussed. Information sources included satellite imagery as well as more conventionally collected data. A detailed discussion and analysis of the wave data available for the South Atlantic OCS region is presented. The seasonal physical characteristics of water masses are presented and discussed. Parameters analyzed and presented in graphs include temperature, salinity, sigma-t, dissolved oxygen, nitrate, phosphate, and silicate. J.M.S.

N80-27066# Environmental Research and Technology, Inc., Concord, Mass.
SUMMARY AND ANALYSIS OF PHYSICAL OCEANOGRAPHIC AND METEOROLOGICAL INFORMATION ON THE CONTINENTAL SHELF AND BLAKE PLATEAU. VOLUME 5; SECTIONS 6, 7, AND 8 Final Report, 1977
Jul. 1979 373 p refs
(Contract DI-AA550-CT-7-16)
(PB-80-159098; ERT-P-2904-Vol-3; BLM/YM/ES-79/22) Avail: NTIS HC A16/MF A01 CSCL 08C

The general circulation and oceanographic conditions on the continental shelf are discussed based on many types of data including: hydrography, current meter, climatology, tidal gauge, atmospheric forcing, and drift-buoy data. The most recent current meter data available are used in the analysis. A qualitative discussion of the interaction of the Gulf Stream with the Continental Shelf and Blake Plateau is given based on a heat balance formulation and satellite imagery. The biological consequences of the hydrography and circulation on the Continental

Shelf and Blake Plateau are presented. Recommendations for future studies and research are presented. J.M.S.

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-27067* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD AND AUTOMATED APPARATUS FOR DETECTING COLIFORM ORGANISMS Patent
W. Preston Dill (Boeing Aerospace Co., Houston, Tex.), Rueben E. Taylor (Boeing Aerospace., Houston, Tex.), and Eldon L. Jeffers, inventors (to NASA) (Boeing Aerospace Co., Houston, Tex.) Issued 20 May 1980 14 p Filed 4 Apr. 1978 Sponsored by NASA
(NASA-Case-MSC-16777-1; US-Patent-4,204,037; US-Patent-Appl-SN-893657; US-Patent-Class-435-3; US-Patent-Class-23-230B; US-Patent-Class-204-195B; US-Patent-Class-422-68; US-Patent-Class-435-32; US-Patent-Class-435-34; US-Patent-Class-435-38; US-Patent-Class-435-39; US-Patent-Class-435-289; US-Patent-Class-435-290; US-Patent-Class-435-291; US-Patent-Class-435-311; US-Patent-Class-435-316) Avail: US Patent and Trademark Office CSCL 06C

Method and automated apparatus are disclosed for determining the time of detection of metabolically produced hydrogen by coliform bacteria cultured in an electroanalytical cell from the time the cell is inoculated with the bacteria. The detection time data provides bacteria concentration values. The apparatus is sequenced and controlled by a digital computer to discharge a spent sample, clean and sterilize the culture cell, provide a bacteria nutrient into the cell, control the temperature of the nutrient, inoculate the nutrient with a bacteria sample, measures the electrical potential difference produced by the cell, and measures the time of detection from inoculation.
Official Gazette of the U.S. Patent and Trademark Office

N80-27068*# National Aeronautics and Space Administration, Washington, D. C.
CHANGE IN RADIOSENSITIVITY OF RATS DURING HYPOKINETIC STRESS
I. P. Chernov Jan. 1980 11 p refs Transl. into ENGLISH from Radiobiologiya (USSR), no. 4, 1978 p 574-578 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75968) Avail: NTIS HC A02/MF A01 CSCL 06C

The laws governing stress modification of radiation sickness in relation to hypokinetic stress were investigated. It was found that gamma irradiation (800 rad) of rats on the third day of exposure to hypokinesia increased the radiosensitivity of the animals which was determined by the survival rate and the dynamics of body weight and the weight of some internal organs. The same radiation dose was given on the 20th day of hypokinesia and on the third day of recovery from the 20 day hypokinesia decreased the radiosensitivity of rats. It is concluded that the variations in the radiosensitivity observed may be due to a stress effect of hypokinesia. R.E.S.

N80-27069*# Oregon Univ. Health Sciences Center, Portland. Dept. of Neurology.
COUNTERCURRENT DISTRIBUTION OF BIOLOGICAL CELLS Final Report, 1 Jan. 1978 - 31 Mar. 1979
D. E. Brooks Mar. 1979 46 p refs
(Contract NAS8-32817)
(NASA-CR-161487) Avail: NTIS HC A03/MF A01 CSCL 06C

A neutral polymer phase system consisting of 7.5 percent dextran 40/4.5 percent PEG 6, 0.11 M Na phosphate, 5 percent fetal bovine serum (FBS), pH 7.5, was developed which has a high phase droplet electrophoretic mobility and retains cell viability over many hours. In this and related systems, the drop mobility was a linear function of drop size, at least in the range 4-30 micron diameter. Applications of and electric field of 4.5 v/cm to a system containing 10 percent v/v bottom phase cleared the system more than two orders of magnitude faster than in the absence of the field. At higher bottom phase concentrations a secondary phenomenon intervened in the field driven separations which resulted in an increase in turbidity after clearing had commenced. The increase was associated with a dilution of the phase system in the chamber. The effect depended on the presence of the electric field. It may be due to electroosmotic flow of buffer through the Amicon membranes into the sample chamber and flow of phase system out into the rinse stream. Strategies to eliminate this problem are proposed. R.E.S.

N80-27070*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF SHARPLY LOWERED MUSCULAR ACTIVITY ON THE THYROID GLAND OF THE WHITE RAT
K. Bekishev Apr. 1980 9 p refs Transl. into ENGLISH from Izv. Akad. Kaz. Khim. SSR, (USSR) no. 2, Mar. - Apr. 1978 p 75-78 Transl. by Kanner (Leo) Associates, Redwood, Calif.
(Contract NASw-3199)
(NASA-TM-76114) Avail: NTIS HC A02/MF A01 CSCL 06C

The effect of hypokinesia on the thyroid gland of 200 white rats was studied. The rats were kept in 16x8x8 cm cages for 90 days. The functional activity of the thyroids increased after 24 hrs of partial immobilization and peaked after 15 days. After 30 days of immobilization, the functional activity returned to normal in one third of the test animals and after 60 days in all animals. After 15 days of immobilization, the test animals began to lose weight (in comparison to the controls) and remained underweight for the rest of the test period (up to 90 days). When returned to normal conditions, they caught up with and even overtook in weight the control animals after about 1 month. All changes produced by hypokinesia were reversible after 1 month. Author

N80-27071*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT PRODUCED BY PHENOBARBITAL, SEX HORMONE AND BY CASTRATION ON THE DEVELOPMENT OF GASTRIC MUCOSA DESTRUCTION DUE TO ELECTRIZATION OF IMMOBILIZED RATS
P. S. Botsolin May 1980 7 p refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), v. 31, no. 2, 1968 p 197-199 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-76156) Avail: NTIS HC/ A02/MF A01 CSCL 06C

The action of phenobarbital on the development of gastric mucosa destruction in rats, brought on through three hours of electrization of immobilized animals, was studied. The evidence showed that phenobarbital exerts a preventive action on the development of destructive lesions affecting the gastric mucosa in non-castrated rats of both sexes, in non-castrated males receiving testosterone propionate, as well as in castrated males and non-castrated females receiving diethylstilbestrol propionate. In castrated female rats, however, phenobarbital proved to be of little effect. Author

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-27072* National Aeronautics and Space Administration. Pasadena Office, Calif.
SIMULTANEOUS MUSCLE FORCE AND DISPLACEMENT TRANSDUCER Patent
Cyril Feldstein (JPL), Gilbert W. Lewis (JPL), and Virgil H. Culler, inventors (to NASA) (JPL) Issued 27 May 1980 5 p Filed 30 Sep. 1977 Supersedes N80-12730 (18 - 03, p 0376) Sponsored by NASA
(NASA-Case-NPO-14212-1; US-Patent-4,204,544; US-Patent-Appl-SN-838308; US-Patent-Class-128-642; US-Patent-Class-128-774; US-Patent-Class-128-782; US-Patent-Class-33-125R; US-Patent-Class-73-781; US-Patent-Class-338-2) Avail: US Patent and Trademark Office CSCL 06B

A myocardial transducer for simultaneously measuring force

and displacement within a very small area of myocardium is disclosed. The transducer comprised of an elongated body forked at one end to form an inverted Y shaped beam with each branch of the beam constituting a low compliant tine for penetrating the myocardium to a predetermined depth. Bonded to one of the low compliance tines is a small piezoresistive element for converting a force acting on the beam into an electrical signal. A third high compliant tine of the transducer, which measures displacement of the myocardium in a direction in line with the two low compliant tines, is of a length that just pierces the surface membrane. A small piezoresistive element is bonded to the third tine at its upper end where its bending is greatest. Displacement of the myocardium causes a deformation in curvature of the third tine, and the second small piezoresistive element bonded to the surface of its curved end converts its deformation into an electrical signal.

Official Gazette of the U.S. Patent and Trademark Office

N80-27073*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN IMPLANTABLE ELECTRICAL DEVICE Patent Application

Murzban D. Jhabvala, inventor (to NASA) Filed 27 May 1980 12 p

(NASA-Case-GSC-12560-1; US-Patent-Appl-SN-153246) Avail: NTIS HC A02/MF A01 CSCL 06B

A fully implantable and self-contained therapeutic device for stimulating the regeneration of severed nerves by electrical energy is disclosed. The device is composed of a flexible electrode array for surrounding damaged nerves and a signal generator for driving the electrode array with periodic electrical impulses of nanoampere magnitude to induce regeneration of the damaged nerves. NASA

N80-27074*# National Aeronautics and Space Administration, Washington, D. C.

CHANGES IN LEUKOCYTE STABILITY IN HYPODYNAMIA

I. I. Federov, Z. P. Federova, Ye. N. Pekus, and T. L. Sakun Jan. 1980 8 p refs Transl. into ENGLISH from Vrach. Delo. (USSR), Apr. 1972, p 44-48 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-2791)

(NASA-TM-75944) Avail: NTIS HC A02/MF A01 CSCL 06P

Leukocytolysis was determined under conditions of hypokinesia of 10 days to 1 month duration in healthy persons and in experiments on albino rats of 1 month duration. It was found that prolonged restriction of movement resulted, both in clinical and experimental conditions, in a considerable increase of leukocytolysis (by two-three-fold). Leukocytolysis also continued for several days after cessation of hypokinesia. R.E.S.

N80-27075*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ERROR ANALYSIS AND CORRECTIONS TO PUPIL DIAMETER MEASUREMENTS WITH LANGLEY RESEARCH CENTER'S OCULOMETER

C. L. Fulton (Purdue Univ.) and R. L. Harris, Jr. May 1980 17 p refs

(NASA-TM-81806) Avail: NTIS HC A02/MF A01 CSCL 06B

Factors that can affect oculometer measurements of pupil diameter are: horizontal (azimuth) and vertical (elevation) viewing angle of the pilot; refraction of the eye and cornea; changes in distance of eye to camera; illumination intensity of light on the eye; and counting sensitivity of scan lines used to measure diameter, and output voltage. To estimate the accuracy of the measurements, an artificial eye was designed and a series of runs performed with the oculometer system. When refraction effects are included, results show that pupil diameter is a parabolic function of the azimuth angle similar to the cosine function predicted by theory: this error can be accounted for by using a correction equation, reducing the error from 6% to 1.5% of the actual diameter. Elevation angle and illumination effects were found to be negligible. The effects of counting sensitivity and output voltage can be calculated directly from system documentation. The overall accuracy of the unmodified system is about 6%. After correcting for the azimuth angle errors, the overall accuracy is approximately 2%. Author

N80-27076*# National Aeronautics and Space Administration, Washington, D. C.

SOME PROBLEMS OF HUMAN ADAPTATION AND ECOLOGY UNDER THE ASPECT OF GENERAL PATHOLOGY

V. P. Kaznacheyev Jul. 1980 15 p refs Transl. into ENGLISH from Vestn. Akad. Med. Nauk SSSR (USSR), no. 11, Nov. 1979 p 51-57 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(NASA-TM-76095) Avail: NTIS HC A02/MF A01 CSCL 06S

The main problems of human adaptation at the level of the body and the population in connection with the features of current morbidity of the population and certain demographic processes are analyzed. The concepts of health and adaptation of the individual and human populations are determined. The importance of the anthropo-ecological approach to the investigation of the adaptation process of human populations is demonstrated. Certain features of the etiopathogenesis of diseases are considered in connection with the population-ecological regularities of human adaptation. The importance of research on general pathology aspects of adaptation and the ecology of man for planning, and organization of public health protection is discussed. Author

N80-27077*# National Aeronautics and Space Administration, Washington, D. C.

THE USE OF ANTIGRAVITY SUITS IN THE TREATMENT OF IDIOPATHIC ORTHOSTATIC HYPOTENSION

K. Landmark and S. Kravik Apr. 1980 8 p refs Transl. into ENGLISH from Tidsskr. Norske Laegforen. (Norway), v. 99, no. 30, 1979 p 1530-1531 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75804) Avail: NTIS HC A02/MF A01 CSCL 06E

Idiopathic orthostatic hypotension is an uncommon disease characterized by a drop in blood pressure when going from a recumbent to a standing position. Treatment by medication generally produces poor results. Three patients at the Royal Hospital in Oslo were treated with antigravity suits and all were able to maintain adequate blood pressures in the standing position. One patient improved dramatically and was able to take short walks while wearing the suit. The two other patients, however, felt that wearing the suits eventually became uncomfortable. This treatment represents a useful treatment alternative for intractable cases. Author

N80-27078*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECT OF HYPODYNAMIA ON MINERAL AND PROTEIN METABOLISM IN CALCIFIED TISSUES OF THE MAXILLODENTAL SYSTEM (EXPERIMENTAL RADIOISOTOPE STUDY)

A. A. Prokhonchukov, Ye. A. Kovalenko, A. G. Kolesnik, Yu. I. Kondratyev, and N. A. Ilyushko Jul. 1980 15 p refs Transl. into ENGLISH from Stomatologiya (USSR), v. 49, no. 4, 1970 p 1-6 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Central Dental Research Inst., Moscow

(Contract NASw-3199)

(NASA-TM-75998) Avail: NTIS HC A02/MF A01 CSCL 06P

Mineral and protein metabolism was studied in experiments on 60 white rats, using P-32 and Ca-45 uptake in the mineral fractions, 2C-14-glycine in the protein fractions, and P-32 in both fractions of calcified tissues as indices over a 100 day period of experimental hypodynamia. Combined alterations in mineral and protein metabolism occurred in the calcified tissues of the experimental animals. The most pronounced changes were found in P-32 and 2C-14-glycine metabolism. In the incisors and femoral bones, these alterations occurred in two phases: P-32 and 2C-14-glycine uptake first increased, then decreased. Changes in Ca-45 metabolism were less pronounced, particularly in the initial period of the experiment. A marked reduction in P-32, Ca-45, and 2C-14-glycine uptake was found in various fractions of the calcified tissues on the 100th day of experimental hypodynamia. Author

N80-27079*# National Aeronautics and Space Administration, Washington, D. C.
THE BEHAVIOR OF FATTY ACIDS IN THE BLOOD PLASMA OF MONKEYS FOLLOWING EXPOSURE TO SHORT TERM STRESSES
M. L. Michailov, U. Gnuechtel, S. Nitschkoff, R. Baumann, and G. Gneuck May 1980 8 p refs Transl. into ENGLISH from Acta Biol. Med. Ger. (East Germany), v. 32, 1974 p 675-680 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by East German Acad. of Sci.
(NASA-TM-76151) Avail: NTIS HC A02/MF A01 CSCL 06P

Monkeys exposed to short term stresses (immobilization, jealousy) were found to develop hyperlipacidemia with a rise in concentration of unsaturated fatty acids in blood plasma, especially of oleic acid, and a relative decrease of saturated free fatty acids, chiefly of palmitinic acid. This finding was more pronounced under immobilization stress than in the jealousy situation. Meanwhile, the composition of triglycerides did not change essentially under the conditions used. Author

N80-27080# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
HUMAN RESPONSE TO HYPOXIA-MOTION SICKNESS STRESS AS A PREDICTOR OF THE SPACE SICKNESS SYNDROME
Aaron V. Barson, Jr. Oct. 1979 6 p refs Presented at Intern. Aerospace Federation, Manila, 8-12 Oct. 1979 Sponsored by AE
(AF Proj. 7231)
(AD-A080306; AMRL-TR-79-86) Avail: NTIS HC A02/MF A01 CSCL 06/19

The change observed during the hypoxia runs supports the hypothesis that hypoxic states lower human tolerance to vestibular stimuli. The frequency of occurrence of symptoms in this study is encouraging since little change in presentation was found between the normoxia and hypoxia runs. Large variations in the symptom presentations would have indicated that hypoxia symptoms were being misread as motion sickness symptoms, thereby skewing the results. From these results it is obvious that a significant research effort is needed to futher delineate and verify the various aspects of this theory. Additional human investigations in one-g and zero-g are needed to verify that the proposed hemodynamic changes and oxygenation parameters potentiates or causes space sickness. Animal studies will be needed to quantify the type and amount of circulatory disruption and hypoxia caused by zero-g exposure. If hypoxia proves to be implicated in the space sickness syndrome, it may be possible to use this hypoxia-motion sickness stress response as an indicator (in earth gravity) of a person's susceptibility to zero-g space sickness. GRA

N80-27081# California Univ., Berkeley. Lawrence Berkeley Lab. Physics Computer Science and Mathematics Div.
MAGNETIC FIELD ON HUMANS: EPIDEMIOLOGICAL STUDY DESIGN, PART 2
John S. Colonias Sep. 1979 20 p refs
(Contract W-7405-eng-48)
(LBL-9357-Pt-2) Avail: NTIS HC A02/MF A01

A study, designed to investigate the epidemiological health effects resulting from occupational magnetic field exposure produced by various nuclear instruments such as cyclotrons, bubble chambers, and spectrometers was previously described. The methodology involved in determining the magnetic field exposure to such instruments is described. DOE

N80-27082# Rensselaer Polytechnic Inst., Troy, N. Y.
PRIMARY PRODUCTIVITY, HETEROTROPHY, METABOLIC INDICATORS OF STRESS AND INTERACTIONS IN ALGAL-BACTERIAL MAT COMMUNITIES AFFECTED BY A FLUCTUATING THERMAL REGIME Ph.D. Thesis
David Lawrence Tison 1980 44 p refs
(Contract EY-76-C-09-0001)
(DP-MS-80-14) Avail: NTIS HC A03/MF A01

Thermal habitats in effluent cooling waters from production nuclear reactors at the Savannah River Plant are unlike natural thermal habitats in that the reactor operations are periodically halted, exposing the organisms growing in these thermal habitats to ambient temperatures for unpredictable lengths of time. Rates of primary production, glucose heterotrophy, and the composition of algal-bacterial mat communities growing along a thermal gradient from about 50 to 35 C during periods of reactor operation were studied. Cyanobacteria were the only photoautotrophs in mat communities above 40 C while cyanobacteria and eucaryotic algae comprised the photoautotrophic component of mat communities below 40 C. The heterotrophic component of these communities above 40 C was made up to stenothermic and eurythermic thermophilic bacteria while both eurythermic thermophiles and mesophilic bacteria were found in communities below 40 C. Results of temperature shift experiments indicated that the short-term response of the photoautotrophic component of these communities to thermal stress was an increase in the percentage of photosynthate released extracellularly. DOE

N80-27083# Massachusetts General Hospital, Boston.
CdTe AMBULATORY VENTRICULAR FUNCTION MONITOR
J. L. Lazewatsky, N. M. Alpert, R. H. Moore, C. A. Boucher, H. W. Strauss, G. Entine (Radiation Monitoring Devices, Inc.), R. Chaney (Ohio Nuclear Inc.), and R. Schreiner (Ohio Nuclear Inc.) 1979 5 p refs Presented at IEEE Nucl. Sci. Symp., San Francisco, 17 Oct. 1979
(Contract EY-76-C-02-2541)
(CONF-791037-26) Avail: NTIS HC A02/MF A01

A prototype device consisting of two arrays of CdTe detectors, ECG amplifiers and gate, microprocessor, and tape recorder was devised to record simultaneous ECG and radionuclide blood pool data from the left ventricle for extended periods during normal activity. The device is intended to record information concerning both normal and abnormal physiology of the heart and to permit the evaluation of the pharmaceuticals under everyday conditions. Preliminary results indicate that the device is capable of recording and reading out data from both phantoms and patients. DOE

N80-27084# Chicago Univ., Ill. Dept. of Radiology.
MODIFIED CONJUGATE COUNTING TECHNIQUE FOR QUANTITATIVE MEASUREMENT OF RADIOACTIVITY IN VIVO
B. M. W. Tsui, C.-T. Chen, N. J. Yasillo, C.J. Ortega, and D. B. Charleston 1979 24 p Presented at the 21st Ann. Meeting of the AAPM, Atlanta, 29 Jul. - 2 Aug. 1979 Prepared in cooperation with Franklin McLean Mem. Res. Inst., Chicago
(Contract EY-76-C-02-0069)
(CONF-790782-1) Avail: NTIS HC A02/MF A01

A modified conjugate counting method is presented for studying biochemical transformations in health and disease, in making realistic radiation-absorbed dose estimates, and in developing clinical procedures indicative of abnormal functions. A new instrument design improves the accuracy to within 5%. DOE

N80-27085# National Physical Lab., Teddington (England). Div. of Electrical Science.
DEVELOPMENT OF A METHOD FOR THE TRACEABLE CALIBRATION OF DEFIBRILLATOR ENERGY METERS
J. R. Stockton and R. C. Smith Aug. 1979 41 p refs
(NPL-DES-55) Avail: NTIS HC A03/MF A01

The development, intercomparison and agreement of two independent, traceable methods; one calorimetric and one digital sampling; for the measurement of the energy of cardiac defibrillator pulses, are discussed. The use of the sampling method to calibrate a defibrillator energy meter, a commercial instrument used for the routine calibration of defibrillators is described. Some observations on methods of making future measurements on energy meters and on possible designs for digital energy meters are included. Author (ESA)

N80-27086# Technische Universitaet, Brunswick (West Germany). Sonderforschungsbereich 58.
HEART RATE VARIABILITY, PILOT WORKLOAD, TASK DIFFICULTY, TRACKING
Fred Volker Schick and Hans Radke Jul. 1979 38 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-653) Sponsored by DFVLR
(DFVLR-FB-79-33) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8,60

The usefulness of measurements of heart rate variations for the assessment of pilot workload was studied in a laboratory experiment. Statistical methods were used to analyze the data. The heart rate variations were studied as a function of standard deviations, sums of absolute differences, and frequencies of reversals of instantaneous heart rate. Author (ESA)

N80-27087# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE EFFECT OF HEARING PROTECTORS ON THE PERCEPTION OF WARNING AND INDICATOR SOUNDS: A GENERAL REVIEW
P. A. Wilkins and A. M. Martin Aug. 1978 217 p refs Sponsored by UK Health and Safety Executive
(ISVR-TR-98) Avail: NTIS HC A10/MF A01

The literature on the auditory effects of wearing hearing protectors was reviewed. A conceptual model of the perception process suggests that the three components, audibility, attention demand and recognition are of importance. Several suggested methods of predicting the audibility of complex sounds in noise are compared and their limitations highlighted. Although a number of studies consider the attention demand of warning sounds, it is concluded that they do not allow any firm conclusions on the effect of inattention to be drawn. Inconsistent use of hearing protectors could, via a temporary shift in the threshold of hearing, result in signals being inaudible when subsequently wearing hearing protectors. It is hypothesized that by reducing the loudness and changing the spectral character of sounds, hearing protectors may impair their attention demand value and their recognition by the wearer. An evaluation of the situation of workers who suffer from an existing noise-induced hearing loss suggests that when wearing hearing protection their perception of sounds in noise may be governed by their doubly elevated absolute thresholds rather than the masker threshold criteria relevant to those with normal hearing. Author (ESA)

N80-27088# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
AN EVALUATION OF MICROWAVE EMISSIONS FROM SENSORMATIC ELECTRONIC SECURITY SYSTEMS Final Report
Howard I. Bassen Feb. 1980 8 p refs
(PB80-155385; DHEW/PUB-FDA-80-8106) Avail: NTIS HC A02/MF A01 CSCL 13L

The concern over potential microwave radiation hazards associated with models of the Sensormatic Electronic Security System has recently been expressed by various groups in the public health, labor, and industrial sectors. Because of this concern, a reevaluation of these specific devices was initiated to confirm Bureau of Radiological Health measurements taken on early models of this device in 1971. The findings of both the early survey, and this more recent one, confirm the BRH's position that emissions from the Sensormatic devices fall well below current U. S. guidelines for permissible exposure of humans to microwave radiation. GRA

N80-27089# Lister Hill National Center for Biomedical Communications, Bethesda, Md. Communications Engineering Branch.
ADAPTIVE DELTA MODULATION FOR TELEPHONE BIOTELEMETRY OF ECG (ELECTROCARDIOGRAPH) Final Report
Surachai Suthasinekul Jun. 1979 57 p refs
(PB80-160773; LHNCBC-79-21) Avail: NTIS HC A04/MF A01 CSCL 06B

Signal processing techniques and their applications in biomedical communications were investigated. Emphasis was on the application of digital coding techniques in telephone biotelemetry of electrocardiograph (EEG) signals. Existing techniques for telephone biotelemetry are briefly reviewed, their shortcomings are identified, and some possible solutions to the problems are discussed. One particular approach is the application of adaptive delta modulation (ADM) for digital encoding of ECG. The design and implementation of such an ADM system in the laboratory indicates that three ADM-encoded ECGs can be time-division multiplexed and transmitted through one telephone channel. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-27090*# National Aeronautics and Space Administration, Washington, D. C.
COMMUNITY REACTIONS TO AIRCRAFT NOISE IN THE VICINITY OF AIRPORT: A COMPARATIVE STUDY OF THE SOCIAL SURVEYS USING INTERVIEW METHOD
Yasutaka Osada Apr. 1980 18 p refs Transl. into ENGLISH of Koshu Eiseiin Kenkyu Hokoku (Tokyo), v. 20, no. 2, 1971 p 119-127 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75439) Avail: NTIS HC A02/MF A01 CSCL 05J

A comparative study was performed on the reports of community reactions to aircraft noise. The direct and immediate reactions to aircraft noise such as perceived noisiness, interference with conversations, etc. and various emotional influences were most remarkable; indirect and long term influences such as disturbance of mental work and physical symptoms were less remarkable. Author

N80-27091*# Boeing Commercial Airplane Co., Seattle, Wash.
NASA TLA WORKLOAD ANALYSIS SUPPORT. VOLUME 2: METERING AND SPACING STUDIES VALIDATION DATA
James L. Sundstrom Jul. 1980 402 p refs
(Contract NAS1-13741)
(NASA-CR-3239) Avail: NTIS HC A18/MF A01 CSCL 05H

Four sets of graphic reports--one for each of the metering and spacing scenarios--are presented. The complete data file from which the reports were generated is also given. The data was used to validate the detail task of both the pilot and copilot for four metering and spacing scenarios. The output presents two measures of demand workload and a report showing task length and task interaction. R.E.S.

N80-27092*# National Aeronautics and Space Administration, Washington, D. C.
THE MORALE CLIMATE OF THE CREW (FROM OBSERVATIONS OF A SUBMARINE DOCTOR)
V. Kulikov Jul. 1980 8 p Transl. into ENGLISH from Morsk. Sb. (USSR), no. 7, Jul. 1979 p 35-38 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76094) Avail: NTIS HC A02/MF A01 CSCL 05J

Personnel interrelationships as affected by sociopsychological compatibility are examined. Practical examples are cited. The principle of complementary temperaments is explored. Stress is laid upon the need for creating conditions that will permit personnel to deal with compatibility problems during the prevoyage preparation period and especially during the confining conditions of a long voyage. J.M.S.

N80-27093*# Boeing Commercial Airplane Co., Seattle, Wash.
NASA TLA WORKLOAD ANALYSIS SUPPORT. VOLUME 3: FFD AUTOPILOT SCENARIO VALIDATION DATA Final Report
James L. Sundstrom Jul. 1980 361 p
(Contract NAS1-13741)
(NASA-CR-3240) Avail: NTIS HC A16/MF A01 CSCL 05H

The data used to validate a seven time line analysis of forward flight deck autopilot mode for the pilot and copilot for NASA B737 terminal configured vehicle are presented. Demand workloads are given in two forms: workload histograms and workload summaries (bar graphs). A report showing task length and task interaction is also presented. R.E.S.

N80-27094# Air Force Human Resources Lab., Brooks AFB, Tex. Flying Training Div.
APPLIED BEHAVIOR ANALYSIS IN FLYING RESEARCH Interim Report, Jun. - Aug. 1978
Jon S. Bailey (Florida State Univ., Tallahassee) and Ronald G. Hughes Jan. 1980 17 p refs

(AF Proj. 1123)
(AD-A081750; AFHRL-TR-79-38) Avail: NTIS HC A02/MF A01 CSCL 05/9

Research developments in learning theory over the past 50 years have led to principles of behavior which have been shown in innumerable applied settings to be valuable in analyzing and modifying human behavior. When applied to flying training using simulators, these principles suggest that a significant contribution could be made in improving the way in which instructor pilots teach new students via more effective use of simulator functions. In addition, flying skills could probably be acquired more readily if tasks were presented in a more systematic manner, taking the principles of learning into account. When the simulator is conceptualized as merely an inferior copy of an aircraft, its potential as a teaching device (perhaps superior to the actual plane, in this regard) is likely to be overlooked. Thus, a behavioral analysis of optimal conditions of learning would make a major contribution to both the design and use of current and future flight simulators. In this report, an attempt is made to elucidate the basic principles of behavior and to relate them to the task of improving flying training. GRA

N80-27096# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
THE INFLUENCE OF THE FLIGHT ALTITUDE AND THE LIMITATION OF THE FIELD OF VIEW ON THE VISIBILITY OF TARGETS ON THE GROUND AND THE MAXIMUM VISIBILITY FLIGHT ALTITUDE
Hans-Eberhard Hoffmann Sep. 1979 44 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-654)
(DFVLR-FB-79-35; ESA-TT-654) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8.60

The visibility of targets on the ground for observers in an aircraft was studied. The maximum flight altitudes at which detection, recognition, or identification of ground targets is still possible were calculated under the assumption that the visibility distance is a logarithmic function of the altitude. The constants of this function were determined experimentally. Author (ESA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

No abstracts in this category.

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N80-27086# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
THE COMPUTER IN PHYSICAL GEOGRAPHY [DE COMPUTER IN DE FYSISCH GEOGRAFIE]
1979 118 p refs In DUTCH Proc. held in Amsterdam, 14 Apr. 1978
Avail: NTIS HC A06/MF A01

Topics include: computerized modeling and simulation, image processing of satellite photographs, on-line literature searching, processing of metrology data, and statistical analysis of geographical data. For individual titles, see N80-27097 through N80-27103.

N80-27097# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
THE COMPUTER AS AN INSTRUMENT IN PHYSICAL GEOGRAPHY [DE COMPUTER ALS HULPMIDDEL IN DE FYSISCHE GEOGRAFIE] c60
Rob vanderTuin *In its* The Computer in Phys. Geograph. 1979 p 1-11 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

A general description of computer hardware and programming languages and concepts is given, along with the organization of the academic computer center in Amsterdam (SARA). Author (ESA)

N80-27098# Amsterdam Univ. (Netherlands). Landbouwhogeschool Wageningen.
COMPUTER SYSTEMS AND SIMULATION MODELS [COMPUTER SYSTEMEN EN SIMULATIE MODELLEN] c62
Johan A. A. Berkhout *In its* The Computer in Phys. Geograph. 1979 p 13-33 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

Examples from the field of geography are used to demonstrate the capabilities of the computer for modeling and the steps involved in constructing a model. The importance of grouping the variables is stressed. These are identified as the state variables, forcing, rate, auxiliary, and output variables. Author (ESA)

N80-27099# International Training Centre for Aerial Survey, Enschede (Netherlands).
DIGITAL IMAGE PROCESSING OF SATELLITE PHOTOGRAPHS [DIGITALE BEELDVERWERKING VAN SATELLIET OPNAMEN] c43
Nico H. W. Donker *In* Amsterdam Univ. The Computer in Phys. Geograph. 1979 p 35-61 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

The significance of remote sensing for developing countries is emphasized, and some applications mentioned, using LANDSAT data in particular. Also discussed are digital imagery, geometric and radiometric corrections, and automatic classification of soil cover using multispectral data. Author (ESA)

N80-27100# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
COMPUTERIZED LITERATURE SEARCHING IN THE GEOGRAPHIC SCIENCES [LITERATUUR ZOEKEN MET DE COMPUTER, IN HET BIJZONDER BIJ DE GEOGRAFISCHE WETENSCHAPPEN] c82
Piet Tielman *In its* The Computer in Phys. Geograph. 1979 p 83-89 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

An overview of developments in the mechanization of libraries and document centers is presented, including on-line information retrieval, computer techniques applied to catalogs in scientific libraries, automatic indexing, and COM produced catalogs. Author (ESA)

N80-27101# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
AUTOMATED PROCESSING OF SENSOR DATA [DE GEAUTOMATISEERDE VERWERKING VAN MEETGEGEVENS] c61
Ed deWater *In its* The Computer in Phys. Geograph. 1979 p 91-113 In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

The evolution of data acquisition and data processing

techniques is reviewed. The characteristics of digital and analog recording, and the conversions of data on cassettes to nine track computer readable format are explained. Author (ESA)

N80-27102# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
A PROGRAM FOR THE AUTOMATIC PROCESSING OF MEASUREMENT DATA [EEN PROGRAMMA VOOR DE AUTOMATISCHE VERWERKING VAN MEETGEGEVENS] **c61**
Rob vanderTuin *In its* The Computer in Phys. Geograph. 1979 p 103-114 In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

The use of a data logger to gather hydrological field data, and the subsequent processing of the cassette tapes are described. Precipitation intensity and quantity, water levels and temperature, soil temperature, pH, conductivity and turbidity were recorded. A FORTRAN program is given for reformating and plotting the cassette data. Author (ESA)

N80-27103# International Training Centre for Aerial Survey, Enschede (Netherlands).
COMPUTERIZED STATISTICAL PROCESSING, PARTICULARLY WITH THE SPSS PACKAGE [STATISTICHE BEWERKINGEN MET DE COMPUTER, IN HET BIJONDER MET HET PROGRAMMAPAKKET SPSS] **c61**
Harry vanZon *In* Amsterdam Univ. The Computer in Phys. Geograph. 1979 p 115-123 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

The development of program libraries as a result of growing computation loads and the complexity of statistical programs are outlined. Precautions to be taken by the users of standardized programs are mentioned. The use of the Statistical Package for the Social Sciences, including data management techniques is briefly described. Author (ESA)

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see 33 Electronics and Electrical Engineering.

N80-27104# Stanford Linear Accelerator Center, Calif.
COM: A UNIBUS TROUBLE SHOOTING TOOL
Gerard J. Oxoby and Quang H. Trang Mar. 1980 7 p refs (Contracts EY-76-C-03-0515; DE-AC03-76SF-00515) (SLAC-TN-80-1) Avail: NTIS HC A02/MF A01

In a computer controlled system it is often difficult to trouble shoot the hardware and software. The task is even more complicated in the case of transient faults on a large system with many I/O ports. A module to help diagnose problems on a PDP 11 system was designed and built by Group B at SLAC. It monitors the Unibus control lines, keeps a history of the last sixteen Unibus operations, and can be programmed to interrupt the PDP 11 when a particular word appears either on the address or data lines. DOE

N80-27105# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
COMPUTER ARCHITECTURE AND SOFTWARE TOOLS FOR THE GENERATION AND SIMULATION OF MICROPROGRAMS
Magnus Persson 1979 22 p refs Sponsored in part by Swedish Inst. for Appl. Math. and Swedish Board for Tech. Develop.
(TRITA-NA-7916; TRITA-CS-7904) Avail: NTIS HC A02/MF A01

A summary is presented of five separate papers on microprogramming floating point arithmetic for the Varian-73 computer, a program and microprogram generator for the Varian-73, and a microprogrammed Fast Fourier Transform for the same machine. Author (ESA)

N80-27106# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.
BIPOLAR MICROPROCESSOR CIRCUITS Final Report
Gerhard Weil Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 82 p refs Partly in GERMAN and ENGLISH Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-49) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 16,80

Partial results of a study to develop bipolar microprocessor devices as well as their associated cross assemblers and simulators are reported. Samples of two MSI peripheral devices were produced and work was started on three bipolar microprocessor devices. Author (ESA)

N80-27107# National Technical Information Service, Springfield, Va.
DATA COMPRESSION, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1977
Brian Carrigan Dec. 1979 251 p
(PB80-801640) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

A bibliography of worldwide journal literature citing research on techniques and equipment for data compression is given. Reports on video communications, data management, and computer storage devices are included. The bibliography contains 245 abstracts. GRA

N80-27097# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
THE COMPUTER AS AN INSTRUMENT IN PHYSICAL GEOGRAPHY [DE COMPUTER ALS HULPMIDDEL IN DE FYSISCHE GEOGRAFIE]
Rob vanderTuin *In its* The Computer in Phys. Geograph. 1979 p 1-11 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-27108*# Computer Sciences Corp., Houston, Tex.
PRELIMINARY MATHEMATICAL SPECIFICATIONS FOR AREA TARGETS AND SPACE VOLUMES
M. Bishop Mar. 1979 74 p *ref*
(Contract NAS9-15700)
(NASA-CR-160192; CSC-0229; JSC-14722) Avail: NTIS HC A04/MF A01 CSCL 09B

The preliminary level B/C mathematical specifications for the Mission Control Center (MCC) area targets and space volumes processor are presented. J.M.S.

N80-27109*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPUTER PROGRAM FOR ESTIMATION FROM INCOMPLETE MULTINOMIAL DATA
Karen R. Credeur May 1978 77 p refs
(NASA-TM-78704) Avail: NTIS HC A05/MF A01 CSCL 09B

Coding is given for maximum likelihood and Bayesian estimation of the vector p of multinomial cell probabilities from incomplete data. Also included is coding to calculate and approximate elements of the posterior mean and covariance matrices. The program is written in FORTRAN 4 language for the Control Data CYBER 170 series digital computer system with network operating system (NOS) 1.1. The program requires approximately 44000 octal locations of core storage. A typical case requires from 72 seconds to 92 seconds on CYBER 175 depending on the value of the prior parameter. J.M.S.

N80-27110*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
COMPUTER PROGRAM DOCUMENTATION: CYBER TO

UNIVAC BINARY CONVERSION USER'S GUIDE
E. W. Martin May 1980 13 p
(Contract NAS9-15800)
(NASA-CR-160688; JSC-16692; LEMSCO-14699) Avail: NTIS HC A02/MF A01 CSCL 09B

A user's guide for a computer program which will convert SINDA temperature history data from CDC (Cyber) binary format to UNIVAC 1100 binary format is presented. The various options available, the required input, the optional output, file assignments, and the restrictions of the program are discussed. J.M.S.

N80-27111*# Washington Univ., St. Louis, Mo. McDonnell Center for Space Sciences.
BIRP: SOFTWARE FOR INTERACTIVE SEARCH AND RETRIEVAL OF IMAGE ENGINEERING DATA
Raymond E. Arvidson, Lawrence K. Botel, Edward A. Guinness, and Peter Norberg Jul. 1980 76 p
(Grant NsG-7087)
(NASA-CR-3299; SL-4) Avail: NTIS HC A05/MF A01 CSCL 09B

Better Image Retrieval Programs (BIRP), a set of programs to interactively sort through and to display a database, such as engineering data for images acquired by spacecraft is described. An overview of the philosophy of BIRP design, the structure of BIRP data files, and examples that illustrate the capabilities of the software are provided. M.G.

N80-27112# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
CUBTRI: AUTOMATIC CUBATURE OVER A TRIANGLE
D. P. Laurie Aug. 1979 9 p refs
(CSIR-TWISK-116) Avail: NTIS HC A02/MF A01

An algorithm which implements a method for automatic numerical integration over a triangle is described. An absolute error criterion is used when the mean value of the integrand lies between + or - 1, and a relative error criterion otherwise. Four program modules are supplied: subroutines CUBTRI and CUBRUL, function RNDERR, and a BLOCK DATA module. Separate single precision and double precision versions are supplied in order to take advantage of storage saving devices. M.G.

N80-27113# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
AN ALGORITHM FOR COMPUTING HIGH-ORDER DERIVATIVES OF NOISY EXPERIMENTAL DATA SEQUENCES
H. Hatze Nov. 1979 15 p refs
(CSIR-TWISK-123) Avail: NTIS HC A02/MF A01

An algorithm utilizing optimally regularized (filtered) Fourier series for estimating higher order derivatives of noisy data sequences is described. As the optimal filtering process takes place in the derivative domain, use being made of the statistical information contained in the periodogram of the data sequence, no numerical differentiation as such takes place, and all the problems known to be associated with such a procedure are avoided. The optimally filtered approximation to the function itself is obtained by the same technique. The algorithm is based on known results from time series and approximation theory and offers several advantages when compared with other techniques: the optimally filtered approximations of the function and all its required derivatives are obtained in a single run; compact analytical Fourier representations of the filtered function and the derivatives are available; all the desirable properties of Fourier approximations can be utilized; if fast Fourier transforms are used, the algorithm is computationally far more efficient than other techniques. M.G.

N80-27114*# National Aeronautics and Space Administration, Washington, D. C.
HIGH LEVEL LANGUAGE FOR MEASUREMENT COMPLEX CONTROL BASED ON THE COMPUTER E-100I
B. V. Zubkov Jun. 1980 34 p refs Transl. into ENGLISH of Russian report Pr-404, Moscow, 1978 p 1-32 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academy of Sciences (USSR), Moscow
(Contract NASw-3198)
(NASA-TM-76243; Pr-404) Avail: NTIS HC A03/MF A01 CSCL 09B

A high level language was designed to control the process of conducting an experiment using the computer 'Elektronika-1001'. Program examples are given to control the measuring and actuating devices. The procedure of including these programs in the suggested high level language is described. Author

N80-27115*# National Aeronautics and Space Administration, Washington, D. C.
DESCRIPTION AND TEXTS FOR THE AUXILIARY PROGRAMS FOR PROCESSING VIDEO INFORMATION ON THE YeS COMPUTER. PART 3: TEST PROGRAM 2
V. I.02Naan Borisenko, G. G. and Z. A. Stetsenko Jun. 1980 30 p Transl. into ENGLISH of " " Opisaniyg i Teksty Vspomogatelnykh Program Obrabotki Videoinformatsii na YeS EVM Chast 3. Programma Testa", Rept. Pr-426 Acad. of Sci. USSR Inst. of Space Res., Moscow 1978 p 1-25 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76252; Pr-426) Avail: NTIS HC A03/MF A01 CSCL 09B

The functions were discribed and the operating instructions, the block diagram and the proposed versions are given for modifying the program in order to obtain the statistical characteristics of multi-channel video information. The program implements certain man-machine methods for investigating video information. It permits representation of the material and its statistical characteristics in a form which is convenient for the user.Author

N80-27116# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
VISUAL ANALOG REPRESENTATIONS FOR NATURAL LANGUAGE UNDERSTANDING
David L. Waltz and Lois Boggess Feb. 1979 30 p refs
(Contract N00014-75-C-0612)
(AD-A081956; WP-20) Avail: NTIS HC A03/MF A01 CSCL 05/8

In order for a natural language system to truly "know what it is talking about," it must have a connection to the real-world correlates of language. For language describing physical objects and their relations in a scene, a visual analog representation of the scene can provide a useful target structure to be shared by a language understanding system and a computer vision system. This paper discusses the generation of visual analog representations from input English sentences. It also describes the operation of a LISP program which generates such a representation from simple English sentences describing a scene. A sequence of sentences can result in a fairly elaborate model. The program can then answer questions about relationships between the objects, even though the relationships in question may not have been explicit in the original scene description. Results suggest that the direct testing of visual analog representations may be an important way to bypass long chains of reasoning and to thus avoid the combinational problems inherent in such reasoning methods. GRA

N80-27117# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
THE EVENT BASED LANGUAGE AND ITS MULTIPLE PROCESSOR IMPLEMENTATIONS Ph.D. Thesis
Asher Reuveni Jan. 1980 291 p refs Sponsored in part by ARPA
(Contract N00014-75-C-0661)
(AD-A081950; MIT/LCS/TR-226) Avail: NTIS HC A13/MF A01 CSCL 09/2

This research defines and analyzes a simple language for parallel programming which is designed for multiple processor systems. The language (EBL) is based on events which provide the only control mechanism. Events are explicitly caused by the program, and they activate instances of dynamic program units called event handlers. The only operation that can be performed by an instance of an event handler is the causing of new events. The language constructs are primitive; nevertheless, the capability of hierarchical program design is provided via static modules and other modularity sources. The language does not contain conventional constructs such as: variables, assignment statements, goto statements, iteration constructs, procedures, functions and semaphores; however, these can be easily modeled. In addition, events allow activation of parallel processes, synchronization of parallel processes, mutual exclusion, message passing, immutable

objects, and the effect of mutable objects. Schemes for implementation of the language on processor networks are investigated. An implementation scheme based on communicating managers which operate without any centralized control is described. A relaxed distributed locking algorithm in which deadlocks are prevented is developed; it does not assume a total order on all objects to be locked. Several optimization problems, e.g., optimal distribution of objects in a network, are investigated. GRA

N80-27118# Naval Surface Weapons Center, Dahlgren, Va. Strategic Systems Dept.

NSWC/DL LIBRARY OF MATHEMATICS SUBROUTINES

Alfred H. Morris, Jr. Mar. 1980 186 p Supersedes NSWC/DL-TR-3843

(AD-A083163; NSWC/TR-79-338; NSWC/DL-TR-3843) Avail: NTIS HC A09/MF A01 CSCL 09/2

This report describes a high quality collection of general-purpose mathematics subroutines for the CDC 6700 computer. The routines are written in FORTRAN. Included are routines for computing Bessel functions, evaluating the complete and incomplete elliptic integrals of the first, second, and third kinds, finding least squares solutions for systems of linear equations, computing eignevalues and eigenvectors of matrices, solving linear programming problems, computing definite integrals, and solving systems of ordinary differential equations. The routines have been selected from a variety of sources. GRA

N80-27119# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.

A RECURSIVE METHOD FOR SOLVING ASSIGNMENT PROBLEMS

Gerald L. Thompson Oct. 1979 45 p refs

(Contracts N00014-76-C-0932; N00014-75-C-0621; NR Proj. 047-048)

(AD-A083596; MSRR-448) Avail: NTIS HC A03/MF A01 CSCL 12/1

The recursive algorithm is a polynomially bounded nonsimplex method for soling assignment problems. It begins by finding the optimum solution for a problem defined from the first row, then finding the optimum for a problem defined from rows one and two, etc., continuing until it solves the problem consisting of all the rows. It is thus a dimension expanding rather than an improvement method such as the simplex. During the method the row duals are non-increasing and the column duals non-decreasing. Best and worst case behavior is analyzed. It is shown that some problems can be solved in one pass through the data, while others may require many passes. The number of zero shifts comparable to degenerate pivots in the primal method is shown to be at most n-squared/2. Extensive computational experience on the DEC-20 computer shows the method to be competitive for at least some kinds of assignment problems. Further tests on other computers are planned. GRA

N80-27120# General Electric Co., Arlington, Va.

A MATCHED PROJECT EVALUATION OF MODERN PROGRAMMING PRACTICES. VOLUME 1: MANAGEMENT REPORT ON THE ASTROS PLAN Interim Report, 1 Sep. 1977 - 30 Nov. 1978

Phil Milliman RADC Griffiss AFB, N.Y. Feb. 1980 53 p refs 2 Vol.

(Contract F30602-77-C-0194; AF Proj. 2528)

(AD-A083512; DOC-791SP005; RADC-TR-80-6-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

A plan for improving software development called Advanced Systematic Techniques for Reliable Operational Software (ASTROS) has been developed. This system provides guidelines for applying the following modern programming practices to software development: structured design and testing, HIPO charts, chief programmer teams, structured coding, structured walk-throughs, and program support library. In order to test the utility of these techniques, two development projects (non-real-time) sponsored by SAMTEC from the Metric Integrated Processing System were chosen for a quasi-experimental comparison. This system provides control and data analysis for missile launches. The Lauch Support Data Base (LSDB) was developed under the guidelines of the ASTROS plan, while the Data Analysis Processor (DAP) was developed using conventional techniques. This volume presents a condensed report of the results of this study which has been prepared for a nonscientific and/or managerial audience. The performance of the LSDB project was comparable to that of similar sized software development projects on numerous criteria. The amount of code produced per man-month was typical of conventional development efforts. Nevertheless, the performance of the LSDB project was superior to that of the DAP project. Thus, the benefits of the modern programming practices employed on the LSDB project were limited by the constraints of environmental factors such as computer access and turnaround time. GRA

N80-27121# General Electric Co., Arlington, Va.

A MATCHED PROJECT EVALUATION OF MODERN PROGRAMMING PRACTICES. VOLUME 2: SCIENTIFIC REPORT ON THE ASTROS PLAN Interim Report, 1 Sep. 1977 - 30 Nov. 1978

Phil Milliman and Bill Curtis RADC Griffiss AFB, N.Y. Feb. 1980 123 p refs 2 Vol.

(Contract F30602-77-C-0194; AF Proj. 2528)

(AD-A083513; DOC-791SP006; RADC-TR-80-6-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 09/2

A detailed account of the theories and analyses underlying the results of a quasi-experimental comparision of the Launch Support Data Base (LSDB) developed under the guidelines of the ASTROS Plan and the Data Analysis Processor (DAP) developed using conventional techniques is presented. The performance of the LSDB Project was comparable to that of similar sized software development projects on numerous criteria. The amount of code produced per man month was typical of conventional development efforts. Nevertheless, the performance of the LSDB Project was superior to that of the DAP Project. The benefits of the modern programming practices employed on the LSDB Project were limited by the constraints of environmental factors such as computer access and turnaround time. J.M.S.

N80-27122# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

TOWARD VALIDATION OF COMPUTER SIMULATION MODELS IN OPERATIONAL TEST AND EVALUATION M.S. Thesis

James M. Arnett Dec. 1979 180 p refs

(AD-A083516; AFIT/GOR/SM/79OD-1) Avail: NTIS HC A09/MF A01 CSCL 09/2

Validation of complex computer simulations is considered in the context of the operational test and evaluation of the air launched cruise missile. Published literature on validation is reviewed. Validation is described as a problem-dependent process. The goal of that process is an acceptable level of confidence that the actual and simulated data agree closely enough for an inference about the simulation to be a valid inference about the actual system. The cost of accepting a given level of confidence must be balanced against the cost of obtaining a higher level. Experimental design is seen as the key to obtaining the maximum amount of information from a limited number of test runs and is discussed. The following approach to validity is suggested. Use a screening design to identify the few, most important variables in the simulation. Use a more complete design to specify parameter/level combinations for simulated and actual data comparison. Finally, explicitly incorporate decision analysis in judging the validity of the model based on that comparison and the use that will be made of the simulation results. A fractional factorial design is used to screen out the important factors from the clutter and multipath sub-model in TAC ZINGER. GRA

N80-27123# Oak Ridge National Lab., Tenn. Computer Sciences Div.

IMPLEMENTING SPARSE MATRIX TECHNIQUES IN THE ERATO CODE

D. S. Scott Apr. 1980 29 p

(Contract W-7405-eng-26)

(ORNL/CSD/TM-117) Avail: NTIS HC A03/MF A01

Changes made to the ERATO code, which computes the stability of an equilibrium with respect to the linear magnetohydrodynamic equation, are described. One program of the code takes given matrices A and B, and a shift parameter, omega sub o, and computes the Choleski factorization (U/sup T/DU)

of the matrix A - omega sub o B. It then uses the factorization to implement inverse iteration to find the eigenvalue of the generalized eigenvalue problem A - lambda B closest to omega sub o and its corresponding eigenvector. The matrices A and B are highly structured and quite sparse. Both are symmetric and B is positive definite. Each block consists of 16 square sub-blocks. DOE

N80-27124# Oak Ridge National Lab., Tenn.
SLIDES 2: A PROGRAM TO DRAW TEXT, SLIDES AND POSTERS
D. H. McCollough and K. N. Fischer Mar. 1980 93 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-103) Avail: NTIS HC A05/MF A01

SLIDES is a program which takes text and commands as input and prepares lettered slides and posters. Originally written by Richard Bertrand and John Schofield at Argonne National Laboratory, SLIDES has been modified to operate in an interactive design mode on the PD-10 as well as in a batch production mode on the IBM computers. When run on the time sharing computer, the program can display its output on a graphics terminal; in batch, it can direct its output to a variety of plotters. The program uses DISSPLA graphical subroutines. This report, revised from ANL-77-25 and again revised from ORNL/CSD/TM-44, contains material written for the beginning user, who should be able to produce useful slides or posters by following the examples. This report also serves as a complete reference for the SLIDES program. DOE

N80-27125# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
AUTOMATED UNCERTAINTY ANALYSIS METHODS IN THE FRAP COMPUTER CODES
S. G. Peck 1980 41 p refs Presented at IAEA Specialists Meeting, Blackpool (England), 17 Mar. 1980
(Contract EY-76-C-07-1570)
(CONF-800331-1) Avail: NTIS HC A03/MF A01

A user oriented, automated uncertainty analysis capability was incorporated in the Fuel Rod Analysis Program (FRAP) computer codes and developed for the analysis of Light Water Reactor fuel rod behavior during steady state (FRAPCON) and transient (FRAP-T) conditions. The objective of uncertainty analysis of these codes is to obtain estimates of the uncertainty in computed outputs of the codes as a function of known uncertainties in input variables. The methods used to generate an uncertainty analysis of a large computer code are presented, the assumptions that are made and are discussed, techniques for testing them are given. An uncertainty analysis of FRAP-T calculated fuel rod behavior during a hypothetical loss-of-coolant transient is presented as an example and carried through the discussion to illustrate the various concepts. DOE

N80-27126# National Physical Lab., Teddington (England). Computing Services Unit.
A CROSS-REFERENCE INDEX FOR THE SYNTAX OF THE PROGRAMMING LANGUAGE FORTRAN 77
R. S. Scowen Dec. 1979 25 p refs
(NPL-CSU-5) Avail: NTIS HC A02/MF A01

The syntax of the new FORTRAN 77 standard is presented in alphabetical order. Cross-reference indexes for both terminal and nonterminal symbols of language are included. The syntax is written in the meta-language defined in a draft British Standard. The report includes a brief description of the meta-language which is similar to that used in ALGOL 60, PASCAL and ADA. Author (ESA)

N80-27127# National Physical Lab., Teddington (England). Computing Services Unit.
A CROSS-REFERENCE INDEX FOR THE SYNTAX OF THE PROGRAMMING LANGUAGE ADA
R. S. Scowen Dec. 1979 17 p refs
(NPL-CSU-6) Avail: NTIS HC A02/MF A01

ADA is a programming language sponsored by the US Department of Defense. The syntax is presented in alphabetical order, with cross-reference indexes for both terminal and nonterminal symbols of the language. The syntax is written in the meta-language defined in a draft British Standard. A brief description of the meta-language which is similar to that used in the ADA manual is included. Author (ESA)

N80-27128# General Electric Co., Whetstone (England). Reactor Equipment LTD.
GENERAL PLOTTING PROGRAM
D. Bartlett May 1979 26 p refs
(REL/R(79)17) Avail: NTIS HC A03/MF A01

Instructions are given for the use of a program written for the PDP 11/70 to plot graphs from tabular data. The graphs can be displayed on a HP2648A graphics terminal and plotted on a HP7221A plotter. The program is not listed. Author (ESA)

N80-27129# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
INTERPRETATION TECHNIQUES
Paul Klint May 1979 21 p refs Submitted for publication
(MC-IW-110/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2.88

The relative merits of implementing high level programming languages by means of interpretation or compilation are discussed. The properties and the applicability of interpretation techniques known as classical interpretation, direct threaded code, and indirect threaded code are described and compared. Author (ESA)

N80-27130# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
A PRELIMINARY REPORT ON NUMERICAL OPERTORS IN ALGOL 68: A SKELETON FOR A MODERN NUMERICAL SOFTWARE LIBRARY
P. W. Hemker and D. T. Winter May 1979 74 p refs
(MC-NW-66/79) Avail: NTIS HC A04/MF A01; Stichting Math. Centrum, Amsterdam FL 7.69

A proposal for a set of numerical operators in ALGOL 68 is described. These operators enable ALGOL 68 users to program standard numerical computations in an easy, flexible way (i.e., in a way resembling the usual mathematical notation). The system of operators serves the same purpose as a numerical library (e.g., FORTRAN or ALGOL 60). Computations in numerical algebra, elementary numerical analysis (quadrature, root-finding) and initial value problems for ODE's are considered. In addition a flexible error message system is provided. Author (ESA)

N80-27131# Research Inst. of National Defence, Stockholm (Sweden).
[ACTIVITIES REPORT OF THE LABORATORY FOR IMAGE PROCESSING] Annual Report, 1979
Jan. 1980 52 p refs
(FOA-C-30179-E1) Avail: NTIS HC A04/MF A01

Application projects centered on image processing, image enhancement, visual perception, visual processing of pictorial information, and evaluation and optimization of information systems are described. Author (ESA)

N80-27132# Montpellier Univ. (France). Dept. de Physique Mathematique.
A PACKAGE OF ROUTINES FOR LINEAR INVERSE PROBLEMS
Michel Cuer and Roger Bayer 1979 36 p refs
(Contract CNEXO-78-5773)
(PM-79/24) Avail: NTIS HC A03/MF A01

A package of FORTRAN routines using linear programming techniques in linear inverse problems such as gravimetry or geomagnetism is described. The package can be applied to inverse gravity or geomagnetic problems with a maximum data size on IBM 360/65 of the order: number of measurements up to 250, number of unknowns 600 or less. Author (ESA)

N80-26359*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPTIMAL PERIODIC BINARY CODES OF LENGTHS 28 TO 64
S. Tyler and R. Keston *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 131-135 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 09B

N80-27101# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
AUTOMATED PROCESSING OF SENSOR DATA [DE GEAUTOMATISEERDE VERWERKING VAN MEETGEGEVENS]
Ed deWater *In its* The Computer in Phys. Geograph. 1979 p 91-113 In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

N80-27102# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
A PROGRAM FOR THE AUTOMATIC PROCESSING OF MEASUREMENT DATA [EEN PROGRAMMA VOOR DE AUTOMATISCHE VERWERKING VAN MEETGEGEVENS]
Rob vanderTuin *In its* The Computer in Phys. Geograph. 1979 p 103-114 In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

N80-27103# International Training Centre for Aerial Survey, Enschede (Netherlands).
COMPUTERIZED STATISTICAL PROCESSING, PARTICULARLY WITH THE SPSS PACKAGE [STATISTICHE BEWERKINGEN MET DE COMPUTER, IN HET BIJONDER MET HET PROGRAMMAPAKKET SPSS]
Harry vanZon *In* Amsterdam Univ. The Computer in Phys. Geograph. 1979 p 115-123 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N80-27133 Duke Univ., Durham, N. C.
PERFORMANCE-ORIENTED DESIGN OF INTERACTIVE COMPUTER SYSTEMS Ph.D. Thesis
Anna Elisabeth Katharina VonMayrhauser 1979 322 p
Avail: Univ. Microfilms Order No. 8012060

Six different design models for interactive systems are studied. The first two are interactive multiprogrammed models with CPU and device speeds as decision variables. One assumes no memory contention, the second restricts access to the computer subsystem based on the amount of memory available. Some of the decision variables for the design optimization are changed to other hardware or software aspects such as device capacities and file assignments across secondary storage devices. The block sizes and record sizes are allowed to vary from device to device and file to file. For each model numerical examples demonstrate its application. The examples also include extensive but efficient sensitivity analyses. Finally an attempt is made to combine all these models into an automated design aid. The structure and features of the proposed design optimizer DESOP are explained including its usefulness and limitations. Dissert. Abstr.

N80-27134# Maryland Univ., College Park. Dept. of Computer Science.
AN ALGORITHM FOR MUTUAL EXCLUSION IN COMPUTER NETWORKS Interim Report
Glenn Ricart and Ashok K. Agrawala Feb. 1980 35 p refs Revised Sponsored in part by NIH
(Grant AF-AFOSR-3654-78; AF Proj. 2304)
(AD-A083268; TR-869-Rev; AFOSR-80-0303TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

An algorithm is proposed which creates mutual exclusion in a computer network whose nodes can communicate only by messages and do not share memory. The algorithm sends only $2*(N-1)$ messages, where N is the number of nodes in the network, per critical section invocation. This number of messages is a minimum if parallel, distributed, symmetric control is used; hence, the algorithm is optimal in this minimal under some general assumptions. Like Lamport's 'bakery algorithm,' unbounded sequence numbers are used to provide first-come first-served priority into the critical section. It is shown that the number can be contained in a fixed amount of memory by storing it as the residue of a modulus. The number of messages required to implement the exclusion can be reduced by using sequential node-by-node processing, by using broadcast message techniques or by sending information through timing channels. The readers and writers problem is solved by a simple modification of the algorithm. The modifications necessary to make the algorithm robust are described. GRA

N80-27098# Amsterdam Univ. (Netherlands). Landbouwhogeschool Wageningen.
COMPUTER SYSTEMS AND SIMULATION MODELS [COMPUTER SYSTEMEN EN SIMULATIE MODELLEN]
Johan A. A. Berkhout *In its* The Computer in Phys. Geograph. 1979 p 13-33 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N80-27135# Honeywell Systems and Research Center, Minneapolis, Minn.
OPTIMAL LINEAR CONTROL Final Report
C. A. Harvey, M. G. Safonov, G. Stein, and J. C. Doyle Dec. 1979 119 p refs
(Contract N00014-75-C-0144; RR01411B4)
(AD-A083130; ONR-CR-215-238-4F; REPT-79-SRC87) Avail: NTIS HC A06/MF A01 CSCL 12/1

This is the final report on a multi-year research program to bridge the gap between modern control theory and practical control system design. The results of the total program are summarized and the last year's results are described in detail. Characterizations of optimal linear controls have been derived, from which guides for selecting the structure of the control system and the weights in the performance index were developed, so that optimal controls meeting conventional design specifications can be designed for single-input systems. For multi-input systems a method of selecting weights for the performance index on the basis of desired closed-loop modal properties and system bandwidth was developed. For such systems it was also found that optimal controls which use state estimators have no guaranteed stability margins, and a method was developed for adjusting the state estimator design so that good margins could be obtained. It was also found that single-loop stability margins in multi-input systems were inadequate measures of robustness, the quality of stability being preserved for a class of perturbations of system characteristics. A new measure of robustness expressed in terms of singular values was developed which is a valid generalization of the concept of stability margins for single-input systems. A method for estimating bounds on system perturbations in terms of singular values associated with parameter uncertainties and unmodeled dynamics, including some forms of nonlinearities, is described in detail in this report. Illustrative examples have been treated in each phase of the program. In this report such an example is presented, demonstrating the se of singular value analysis in design. GRA

N80-27136# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
STOCHASTIC AND ADAPTIVE SYSTEMS Final Report, 1 Feb. 1979 - 31 Jan. 1980
Michael Athans, Sanjoy K. Mitter, and Lena Valavani Mar. 1980 19 p refs
(Grant AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A083614; LIDS-FR-981; AFOSR-80-0304TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This research is concerned with various aspects of stochastic and adaptive systems. Topics covered include: linear and non-linear state estimation, stochastic control and adaptive control. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-27137# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
METHODS FOR SOLUTION OF FREDHOLM INTEGRAL EQUATIONS OF THE FIRST KIND M.S. Thesis - South Africa Univ.
M. L. Baart Sep. 1979 144 p refs
(CSIR-TWISK-104) Avail: NTIS HC A07/MF A01

A Fredholm integral equation of the first kind is an example of an ill-posed problem, the most troublesome aspect being the fact that the solution need not depend continuously on the given function, so that small inaccuracies in the data can cause large solution deviations. Various methods are investigated for solving these integral equations. These methods are divided into three interconnected classes: (1) best approximate solution methods, (2) singular value decomposition methods, and (3) regularization methods. Selected methods from each category are discussed, as well as connections between these methods. Finally, four methods are used to compute solutions to problems with varying degrees of stability. In all cases considered, the exact solutions are known, so that the accuracy of the computed solutions obtained by different methods can be compared. The results provide some justification for a priori selection of the most suitable method in a given case. F.O.S.

N80-27138# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Mathematical Statistics.
ON A FISHER-CORNISH TYPE EXPANSION OF WISHART MATRICES
D. G. Nel and P. C. N. Groenwald Aug. 1979 15 p refs
(TR-47) Avail: NTIS HC A02/MF A01

The limiting distributions of U = the square root of (n)(A/n)-sigma where A is similar to W (sigma,n) or A is similar to W(sigma,n,omega = o(1) is respectively extended to asymptotic approximations to the distributions of U. The Fisher-Cornish approximation to a chi(2)sub n distribution is shown to be a special case of this approximation up to the order terms involved. Asymptotic approximations to the distribution of U = the square root of(n)((A/n)-sigma(1+theta)) is also derived when A is similar to W(sigma,n,omega) and omega = o(n). Author

N80-27139# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OPTIMAL CONTROL OF PARTIALLY OBSERVABLE JUMP DIFFUSION PROCESSES
M. Friedman (Nuclear Research Centre, Beer-Sheva, Israel) Jul. 1979 24 p refs
(CSIR-TWISK-84) Avail: NTIS HC A02/MF A01

The optimal control problem dealt with is to find a feedback control law. By applying the calculus of variations, necessary conditions on optimal controls are derived, these conditions being given by a pair of coupled nonlinear partial integro-differential equations. A stochastic second-order system, describing a perturbed Duffing oscillator, is used as a test case, and two numerical methods for computing the optimal controls of the system are suggested, the efficiency and applicability of the second method is demonstrated with the aid of examples. J.M.S.

N80-27140# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
ROBUST ESTIMATION OF THE VARIOGRAM 1
Noel Cressie Jul. 1979 20 p refs
(CSIR-TWISK-83) Avail: NTIS HC A02/MF A01

It is a matter of common experience that ore values do not follow the normal (or lognormal) distributions assumed for them, but some other heavier-tailed distribution. The robust estimation is discussed of the variogram when the distribution is normal-like in the central region, but heavier than normal in the tails. It is shown that the use of a fourth-root transformation with or without the use of M-estimation yields stable robust estimates of the variogram. Author

N80-27141# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
INITIAL ESTIMATES OF THE MOVING AVERAGE PARAMETERS IN A TIME SERIES MODEL
D. P. Laurie Oct. 1979 12 p refs
(CSIR-TWISK-118) Avail: NTIS HC A02/MF A01

An algorithm for the polynomial factorization involved in the initial estimates of the moving average parameters in a time series model is presented. A two stage algorithm is described which uses a linearly convergent algorithm in the fast version until the current iterate is sufficiently accurate to allow the use of a quadratically convergent algorithm, in the fast version. The FORTRAN subroutines are given. M.G.

N80-27142# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
TANGENTIAL APPROXIMATIONS IN ABSTRACTS MULTIPLIER RULES
R. J. Gardner Oct. 1979 13 p refs Presented at 10th Intern. Symp. on Math. Programming, Montreal, 27-31 Aug. 1979
(CSIR-TWISK-124) Avail: NTIS HC A02/MF A01

An axiomatic examination centering around a very general abstract multiplier rule (The intersection principle) is presented. Notions of tangential approximant which combine the advantages of certain existing notions are developed. M.G.

N80-27143# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A GEOMETRIC CHARACTERIZATION OF H-SETS
M. Brannigan Oct. 1979 13 p refs
(CSIR-TWISK-121) Avail: NTIS HC A02/MF A01

The geometric characterization of H-sets in terms of convex polyhedral cones or, in special cases, simplices is examined. In particular the characterization of minimal H-sets is considered and used to find an upper bound for the number of possible minimal H-sets of a finite-dimensional space. M.G.

N80-27144# Stanford Univ., Calif. Dept. of Computer Science.
RELATION BETWEEN THE COMPLEXITY AND THE PROBABILITY OF LARGE NUMBERS
Peter Gacs Sep. 1979 11 p refs
(Contract N00014-76-C-0330; Grant NSF MCS-77-23738)
(AD-A083192; SU-STAN-CS-79-765) Avail: NTIS HC A02/MF A01 CSCL 12/1

H(x), the negative logarithm of the apriori probability M(x) is Levin's variant of Kolmogorov's complexity of a natural number x. Let alpha(n) be the minimum complexity of a number larger than n, s(n) the logarithm of the a priori probability of obtaining a number larger than n. It was known that s (n) < or = alpha(n) < or = s (n) and H(s(n)). We show that the second estimate is in some sense sharp. GRA

N80-27145# Stanford Univ., Calif. Dept. of Computer Science.
UPDATING FORMULAE AND A PAIRWISE ALGORITHM FOR COMPUTING SAMPLE VARIANCES
Tony F. Chan (Yale Univ.), Gene H. Golub, and Randall J. LeVeque Nov. 1979 21 p refs Sponsored in part by NSF
(Grant DAAG29-78-G-0179)
(AD-A083170; SU-STAN-CS-79-773) Avail: NTIS HC A02/MF A01 CSCL 12/1

A general formula is presented for computing the sample variance for a sample of size m and n given the means of variances for two subsamples of sizes m and n. This formula is used in the construction of a pairwise algorithm for computing the variance. Other applications are discussed as well, including the use of updating formulae in a parallel computing environment. We present numerical results and rounding error analyses for several numerical schemes. GRA

N80-27146# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CONTINUOUS DENSITY APPROXIMATION ON A BOUNDED INTERVAL USING INFORMATION THEORETIC CONCEPTS Ph.D. Thesis
James E. Miller, Jr. Mar. 1980 265 p refs

(AF Proj. 2404)
(AD-A083514; AFIT/DS/MA/80-1) Avail: NTIS HC A12/MF A01 CSCL 12/1

This report presents the theoretical development and numerical implementation of a procedure for approximating continuous probability density functions on a bounded interval. The work is applicable to Bayesian decision models and that available information is used to update or obtain the prior distribution. The procedure is based on the solution of a constrained entropy maximization problem and requires information in the form of expected values of information functions. The approach involves three steps: estimation of expected (or average) values of potential information functions, selection of the active subset of functions to define the approximation family, and simultaneous solution of the constraints to select the specific approximating density for a given set of data. A useful set of potential information functions is developed, and three numerical methods for active set selection are demonstrated. Numerical techniques for expected value computation are discussed, and a scheme for solution of the constraints is developed and implemented. Theoretical development includes theorems on form and uniqueness. Approximation accuracy is related to potential set definition and data accuracy. The procedure is applied to several known distributions to demonstrate applicability. Applications to computer simulation and interval arithmetic models are demonstrated with specific examples. GRA

N80-27147# Union Carbide Corp., Oak Ridge, Tenn. Computer Sciences Div.
KWIC INDEX FOR NUMERICAL ALGEBRA
J. A. Carpenter and R. A. Lewis Mar. 1980 379 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-46) Avail: NTIS HC A17/MF A01

The second supplement to the 'key word in context' (KWIC) index for numerical algebra is presented. The first supplement is included in its entirety, together with the subsequent corrections and recent journal citations. A standard bibliography of 3,864 citations is also included along with an author index. DOE

N80-27148# Oxford Univ. (England). Dept. of Engineering Science.
THE SIGNORINI PROBLEM FOR A COSSERAT PLATE
J. R. Turner 1979 23 p refs
(OUEL-1296/79) Avail: NTIS HC A02/MF A01

The potential of Cosserat plate theory to give physically acceptable solutions to a number of practical plate problems involving unilateral constraints is investigated. Example solutions to three problems are obtained by the finite element method. These are the Signorini problem of a plate bent over a rigid parabolic obstacle, the problem of a plate resting on a rigid, frictionless foundation indented from above by a rigid frictionless ball, and that of a plate bonded to a rigid foundation indented from above by a rigid frictionless ball. Author (ESA)

N80-27149# Royal Netherlands Meteorological Inst., De Bilt. Meteorologisch Onderzoek.
METHODS FOR ESTIMATING SPECTRA [INLEIDING IN ENKELE METHODEN VOOR HET SCHATTEN VAN SPECTRA]
Wouter Kuik 1980 60 p refs In DUTCH
(KNMI-V-335) Avail: NTIS HC A04/MF A01

A literature review was performed of techniques for determining the spectra of finite time series. A historic overview is given, with a discussion of general problems in determining spectra. Specific methods with the advantages and disadvantages of each are presented, including periodogram methods, with or without window, the variable record length technique, maximum entropy method, maximum likelihood method and exact spectral representation based on filtering. Author (ESA)

N80-26355*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ON THE APPLICATION OF A FAST POLYNOMIAL TRANSFORM AND THE CHINESE REMAINDER THEOREM TO COMPUTE A TWO-DIMENSIONAL CONVOLUTION
T. K. Truong, R. Lipes, I. S. Reed (Univ. of Southern California), and C. Wu *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 87-102 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A08/MF A01 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-27150*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN AUTOMATED APPROACH TO THE DESIGN OF DECISION TREE CLASSIFIERS
P. Argentiero, P. Chin, and P. Beaudet Mar. 1980 19 p refs
(NASA-TM-80676) Avail: NTIS HC A02/MF A01 CSCL 12A

The classification of large dimensional data sets arising from the merging of remote sensing data with more traditional forms of ancillary data is considered. Decision tree classification, a popular approach to the problem, is characterized by the property that samples are subjected to a sequence of decision rules before they are assigned to a unique class. An automated technique for effective decision tree design which relies only on apriori statistics is presented. This procedure utilizes a set of two dimensional canonical transforms and Bayes table look-up decision rules. An optimal design at each node is derived based on the associated decision table. A procedure for computing the global probability of correct classification is also provided. An example is given in which class statistics obtained from an actual LANDSAT scene are used as input to the program. The resulting decision tree design has an associated probability of correct classification of .76 compared to the theoretically optimum .79 probability of correct classification associated with a full dimensional Bayes classifier. Recommendations for future research are included. J.M.S.

N80-27151# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Mathematical Statistics.
A CIRCULAR APPROACH TO CYCLICAL DATA
D. J. deWaal and P. H. Hewitt Jul. 1979 12 p refs
(TR-45) Avail: NTIS HC A02/MF A01

An approach to analyzing cyclical data such as the number of mosquitoes over the seasons of a year is presented. The data are presented on the circumference of a unit circle and a predictive density is fitted. As calculated the predictive density can also take account of the effect of possible independent variables. An application using the weekly abundance, over a year, of two mosquito species is given. M.G.

N80-27152# Clemson Univ., S.C. Dept. of Mathematical Sciences.
A NOTE ON THE INCOMPLETE BETA FUNCTION
Khursheed Alam 25 May 1979 11 p refs
(Contracts N00014-75-C-0451; NR Proj. 047-202)
(AD-A083529; N107; TR-316) Avail: NTIS HC A02/MF A01 CSCL 12/1

The incomplete beta function arises in various statistical problems. It is known, for example, that the tail probability of the binomial distribution can be expressed as an incomplete beta function. This paper gives some results on a monotonicity property of the incomplete beta function. The given results are shown to have application in a problem of ranking and selection. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-27153# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
SCIENTIFIC MODELS AND METHODS M.S. Thesis [MODELOS E METODO CIENTIFICO]
Artur Milhomen Neto and Horacio Hideki Yanasse Jan. 1978

402 p refs In PORTUGUESE; ENGLISH summary
(INPE-1180-TPT/080) Avail: NTIS HC A18/MF A01

Models, their role in the scientific method, their construction, and their use are discussed. The current state-of-the-art is appraised. The fundamentals of modeling are examined in relation to the scientific method. After careful study of the scientific method, the aspects are considered: (1) classification of the types of models based on explaining the relation between the variables; and (2) development of methodology, isomorphic to the pragmatic method, for constructing models. Some existing models are criticized, and an orientation for the systematic use of models is presented. Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-27154*# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A NOTE ON THE DUALITY OF TIME-VARYING DECOMPOSABLE SYSTEMS
G. Naude Nov. 1979 11 p refs
(CSIR-TWISK-125) Avail: NTIS HC A02/MF A01

Results on the duality between reachability and observability for time-invariant decomposable systems in a category are extended to the time-varying case. In particular the results can be applied to time-varying infinite-dimensional linear systems in Banach spaces, and to time-varying linear systems over rings. M.G.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-27155# Argonne National Lab., Ill.
RESISTIVITY, HYSTERESIS, AND MAGNETIZATION OF 9% CR STAINLESS STEEL AS A FUNCTION OF TEMPERATURE AND ITS ELECTROMAGNETIC SHIELDING EFFECTS IN CYLINDRICAL STRUCTURES
W. F. Praeg 1979 8 p refs Presented at 8th Symp. on Eng. Problems on Fusion Res., San Francisco, 13-16 Nov. 1979
(Contract W-31-109-eng-38)
(CONF-791102-128) Avail: NTIS HC A02/MF A01

Ferromagnetic stainless steels may offer significantly greater wall life-times for first wall/blanket and vacuum vessel structures than commonly used nonmagnetic stainless steels. One steel under consideration has the following composition, in weight percent, Fe(86.24%), Cr(9.0%) etc. The resistivity, the hysteresis loops, and magnetization were measured as a function of temperature up to the Curie point. DOE

N80-27156# California Univ., Livermore. Lawrence Livermore Lab.
ADIABATIC COMPRESSION AND RADIATIVE COMPRESSION OF MAGNETIC FIELDS
C. H. Woods 12 Feb. 1980 19 p refs
(Contract W-7405-eng-48)
(UCID-18579) Avail: NTIS HC A02/MF A01

Flux is conserved during mechanical compression of magnetic fields for both nonrelativistic compressors. However, the relativistic compressor generates radiation, which can carry up to twice the energy content of the magnetic field compressed adiabatically. The radiation may be either confined or allowed to escape. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-27157*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
APPLICATION OF IMAGING AND ULTRASOUND TO THE QUALITY GRADING OF BEEF
V. J. Anselmo and P. M. Gammell 1 Apr. 1980 41 p Sponsored in part by Dept. of Agriculture. Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-163276; JPL-80-33) Avail: NTIS HC A03/MF A01 CSCL 20A

The results of a study conducted to assist the Department of Agriculture in the task of considering innovative methods for the grading of carcass beef for human consumption is presented. The processing of photographic, television and ultrasound images of the longissimus dorsi muscle at the 12/13th rib cut was undertaken. The results showed that a correlation could be developed between the quality grade of the carcass as determined by a professional grader, and the fat to area ratio of the muscle as determined by image processing techniques. In addition, the use of ultrasound shows the potential for grading of an unsliced carcass or a live animal. E.J.R.

N80-27158*# Wyle Labs., Inc., Huntsville, Ala. Scientific Services and Systems Group.
ANALYSIS OF SRB REENTRY ACOUSTIC ENVIRONMENTS Final Report
T. Coffin, R. E. Dandridge, and U. W. Haddock Jun. 1979 185 p refs
(Contract NAS8-32112)
(NASA-CR-161476; WR-79-15) Avail: NTIS HC A09/MF A01 CSCL 20A

Space shuttle solid rocket booster reentry aeroacoustic environments were estimated. Particular emphasis was given to the aft skirt/exit plane region for the Mach number regime 0.6 - or greater than M infinity - or less than 3.5. The analysis is based on the evaluation of wind tunnel model results in conjunction with Monte Carlo simulation of trajectory parameters. The experimental approach is described as well as the evaluation process utilized. Predicted environments are presented in terms of one-third octave band spectra representing space averaged values for critical regions on the solid rocket booster. A.R.H.

N80-27159*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
BROADBAND JET NOISE AMPLIFICATION BY A PURE TONE EXCITATION Semiannual Report
P. J. Morris 14 Jul. 1980 24 p refs
(Grant NsG-1580)
(NASA-CR-163269) Avail: NTIS HC A02/MF A01 CSCL 20A

A model is proposed for the change in turbulent structure of a round jet in the presence of an acoustic excitation. The excitation is initial amplitude at the jet exit. As these waves propagate downstream they extract energy from the mean flow and transfer it to the random turbulence. This results in an increase in the levels of the turbulence and a resulting increase in the radiated broadband noise. An examination is made of the effect of excitation level and frequency on the jet flow. The numerical procedure allows for radial as well as axial variations in the averaged properties of jet to be calculated. The results indicate that the presence of a finite amplitude instability wave increases the spreading of the jet. Author

N80-27160# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
SOUND RADIATION FROM A FINITE LENGTH UNFLANGED CIRCULAR DUCT WITH UNIFORM AXIAL FLOW
Kenji Ogimoto May 1980 172 p refs
(UTIAS-231; CN-ISSN-0082-5255) Avail: NTIS HC A08/MF A01

In addition to the noise caused by the turbulent jet exhaust flow, the noise generated by the fans and compressors operating in the inlet duct is a dominant contributor to the overall jet aircraft engine noise. To assist in improving the understanding of the basic characteristics of this type of noise source, a general theory is developed using a simplified model. This model

consists of a finite length hard wall unflanged circular duct, an arbitrary general planar source distribution in the duct and a uniform axial flow inside and outside the duct radius. The Wiener-Hopf-Technique, which is useful in solving mixed boundary value problems, was employed in the solution. The study by Williams of the scattering of plane waves by a finite length unflanged hollow cylindrical duct is particularly relevant. The plane wave in Williams' study is replaced by a general planar source distribution inside the duct. In addition, a uniform axial flow inside and outside the duct radius is also included. The model simulates a low thrust engine operating condition such as landing or steady flight and includes the diffraction of sound waves at the duct ends. However, the refraction effects due to the large nonuniform exterior flow fields, which are encountered near the inlet and exhaust under conditions of high thrust (i.e., at take-off) are excluded. The solution in the present work also includes the results of earlier studies with semi-infinite length unflanged circular ducts as a limiting case. However, the present finite length model provides a much improved simulation of the actual flow problem and it drastically changes the picture of the resulting sound radiation. The reasons for the changes are attributable to the resonance within the duct (leading to interior standing waves) and to the interference of the two sound waves radiated to the duct exterior from the duct ends.

Author

N80-27161*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A NUMERICAL TECHNIQUE FOR CALCULATION OF THE NOISE OF HIGH-SPEED PROPELLERS WITH ADVANCED BLADE GEOMETRY

Paul A. Nystrom and F. Farassat Jul. 1980 33 p refs

(NASA-TP-1662; L-13535) Avail: NTIS HC A03/MF A01 CSCL 20A

A numerical technique and computer program were developed for the prediction of the noise of propellers with advanced geometry. The blade upper and lower surfaces are described by a curvilinear coordinate system, which was also used to divide the blade surfaces into panels. Two different acoustic formulations in the time domain were used to improve the speed and efficiency of the noise calculations: an acoustic formualtion with the Doppler factor singularity for panels moving at subsonic speeds and the collapsing sphere formulation for panels moving at transonic or supersonic speeds. This second formulation involves a sphere which is centered at the observer position and whose radius decreases at the speed of sound. The acoustic equation consisted of integrals over the curve of intersection for both the sphere and the panels on the blade. Algorithms used in some parts of the computer program are discussed. Comparisons with measured acoustic data for two model high speed propellers with advanced geometry are also presented. B.D.

N80-27162# National Physical Lab., Teddington (England). Div. of Electrical Science.

A TECHNIQUE FOR CALIBRATING NOISE SOURCES AT MILLIMETRE AND SUBMILLIMETRE WAVELENGTHS

A. E. Costley, J. A. How (CEA, Fontenay aux Roses, France), and D. R. Vizard (Appleton Lab.) Mar. 1978 34 p refs

(NPL-DES-54) Avail: NTIS HC A03/MF A01

A technique for calibrating noise sources in the far infrared and millimeter wavelength range is described. Results obtained with a commercial neon gas discharge microwave noise tube in the range 60 less than F less than 900 GHz and at a minimum resolution of 5 GHz are presented. Also, a comparison is given of the power received from this tube in a typical millimeter/submillimeter wave spectroscopic system to that received with a conventional mercury arc lamp in the same arrangement. The results show that up to eight times more power per unit frequency interval was received with the noise tube over its rated operating range (90 to 140 GHz), indicating that these tubes are useful for broadband spectroscopy at millimeter wavelengths.

Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-27163* National Aeronautics and Space Administration. Pasadena Office, Calif.

MINIATURE CYCLOTRON RESONANCE ION SOURCE USING SMALL PERMANENT MAGNET Patent

Vincent G. Anicich (JPL) and Wesley T. Huntress, Jr., inventors (to NASA) (JPL) Issued 3 Jun. 1980 7 p Filed 11 Sep. 1978 Supersedes N80-12851 (18 - 03, p 0391) Sponsored by NASA

(NASA-Case-NPO-14324-1; US-Patent-4,206,383; US-Patent-Appl-SN-940970; US-Patent-Class-313-362; US-Patent-Class-250-427; US-Patent-Class-313-156; US-Patent-Class-313-363) Avail: US Patent and Trademark Office CSCL 20H

An ion source using the cyclotron resonance principle is described. A miniaturized ion source device is used in an air gap of a small permanent magnet with a substantially uniform field in the air gap of about 0.5 inch. The device and permanent magnet are placed in an enclosure which is maintained at a high vacuum (typically 10 to the minus 7th power) into which a sample gas can be introduced. The ion beam end of the device is placed very close to an aperture through which an ion beam can exit into the apparatus for an experiment.

Official Gazette of the U.S. Patent and Trademark Office

N80-27164*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DIFFERENTIATION OF OPTICAL ISOMERS THROUGH ENHANCED WEAK-FIELD INTERACTIONS

S. Aronowitz Jun. 1980 13 p refs

(NASA-TM-81208; A-8212) Avail: NTIS HC A02/MF A01 CSCL 20 H

The influence of weak field interaction terms due to the cooperative effects which arise from a macroscopic assemblage of interacting sites is studied. Differential adsorption of optical isomers onto an achiral surface is predicted to occur if the surface was continuous and sufficiently large. However, the quantity of discontinuous crystal surfaces did not enhance the percentage of differentiation and thus the procedure of using large quantities of small particles was not a viable technique for obtaining a detectable differentiation of optical isomers on an achiral surface. B.D.

N80-27165*# National Aeronautics and Space Administration, Washington, D. C.

INTERACTION OF THE INTERMEDIATE ENERGY NEUTRINO WITH NUCLEI

E. V. Bugayev, M. A. Rudzskiy, G. S. Bisnovatyy-Kogan, and Z. F. Seidov Jun. 1980 48 p refs Transl. into ENGLISH of "Vzaimodeystviye Neytrino Srednykh Energiy s Yadrami" Rept. PR-403 Acad. of Sci. USSR, Inst. of Space Research, Moscow, 1977 p 1-49 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76242) Avail: NTIS HC A03/MF A01 CSCL 20H

The interaction of the electronic neutrino with nuclei C-12, O-16, Ci-37, Fe-56, Ga-71, and Br81 is considered for neutrino energy up to 300 MeV. The nuclei are described by single-particle shell-model with Woods-Saxon potential. The parameters of the potential are specially chosen for each nuclei in order to describe correctly the upper occupied single particle levels of the nuclei. The cross sections for inelastic and elastic interactions of neutrino with nuclei are calculated within this model, taking into account charged and neutral current of weak interaction. The neutral currents are described by Weinberg theory. The results of the cross section calculations are presented and the comparisons with the results of the other authors are given. The possibilities of improvement of the exactness of obtained results are discussed. Some details of the calculations are included. Author

N80-27166# California Univ., Berkeley. Lawrence Berkeley Lab.

COMPUTATIONAL METHODS FOR MOLECULAR STRUC-

TURE DETERMINATION: THEORY AND TECHNIQUE
1979 397 p Conf. held in Bloomington, Ind. 13-24 Aug. 1979
(Contract W-7405-eng-48; Grant NSF CHE-77-21305)
(LBL-9882; CONF-790892; NRCC-Proc-8) Avail: NTIS HC A17/MF A01

The use of state-of-the-art computer codes for the semi-empirical and ab initio computation of the electronic structure and geometry of small and large molecules is examined. The theoretical foundations of the codes are detailed. Computational quantum chemistry, self consistent field theory, generalized valence bond, the geometry of large systems, and molecular mechanics are among the topics discussed. DOE

N80-27167# Los Alamos Scientific Lab., N. Mex.
LARGE MOMENTUM TRANSFER NEUTRON PICKUP WITH THE PI(+)p) AND (p,d) REACTIONS
Gregory Richard Smith (Schweizerisches Inst. fur Nuklearforschung) Jan. 1980 393 p refs
(Contract W-7405-eng-36)
(LA-8166-T) Avail: NTIS HC A17/MF A01

The (p,d) reaction was studied at 800 MeV on seven targets ranging from Li to Ca. The experimental resolution (400 keV) attained was sufficient to observe many discrete levels in each of the residual nuclei. A modified version of the one nucleon model successfully describes the magnitude and angular dependence of almost all of the transitions observed. A specific counter example to the two nucleon model of the reaction mechanism is suggested. The calculations are also sensitive to the neutron single particle wave function. High resolution measurements of the /p::(+)p/ reaction were also performed on (6)Li,(7)Li,(12)C, and (13)C at pion bombarding energies on and off the pion nucleon resonance. Calculations employing a one-nucleon model of the reaction mechanism similar to the model successfully used for the (p,d) reaction are unable to account for transitions in the /pi(+)p/ reaction. DOE

N80-27168# Argonne National Lab., Ill. High Energy Physics Div.
SPIN MEASUREMENTS IN NUCLEON-NUCLEON SCATTERING UP TO 12 GeV/c, AND PRESENT STATUS OF MANY DINUCLEON RESONANCES
Akihiko Yokosawa 8 Jan. 1980 35 p refs Presented at 2-Nucleon Systems and Dibaryon Resonances Meeting, Hiroshima
(Contract W-31-109-eng-38)
(ANL/HEP-CP-80-01; CONF-791174-1) Avail: NTIS HC A03/MF A01

The processes of proton-proton (PP) scattering for various spin directions are investigated in the beam momentum range of 1 to 12 GeV/c. Various pp scattering parameters are measured at 6 GeV/c, including three-spin parameters, which are sufficient to determine pp elastic scattering amplitudes in a model independent way at 0.2 < the absolute value of t < 0.8 (GeV/c) squared. Measurements of spin-spin correlation parameters have been extended to higher t and higher energies, revealing the importance of the spin-dependent interaction. These measurements may shed light on the nature of the constituents and their interactions. Diproton resonances in the mass region 2100 to 2800 MeV were discussed. Here are presented a number of candidates for I = 0 and I = 1 dinucleon resonances and summarized various evidence for the existence of resonances. DOE

N80-27169# Argonne National Lab., Ill.
MICROSCOPIC ANALYSIS OF PION-NUCLEUS INELASTIC SCATTERING
T. S. H. Lee 1980 12 p refs Presented at Nucl. Struct. with Intermediate Energy Probes Workshop, Los Alamos, N. Mex., 14-17 Jan. 1980
(Contract W-31-109-eng-1)
(CONF-800131-38) Avail: NTIS HC A02/MF A01

Theoretical methods of analyzing pion-nucleus inelastic scattering with energy near the (3,3) resonance are reviewed. It is illustrated that the DWIA in momentum space provides a reasonable tool to reveal microscopically the structure of nuclear states from the existing data. DOE

N80-27170# California Univ., Berkeley. Lawrence Berkeley Lab.
PHOTOELECTRON SPECTROSCOPY OF HEAVY ATOMS AND MOLECULES Ph.D. Thesis
Michael George White Jul. 1979 154 p refs
(Contract W-7405-eng-48)
(LBL-9527) Avail: NTIS HC A08/MF A01

The importance of relativistic interactions in the photoionization of heavy atoms and molecules is investigated by the technique of photoelectron spectroscopy. Experiments are reported which illustrate the effects of the spin orbit interaction in the neutral ground state, final ionic states and continuum states of the photoionization target. DOE

N80-27171# Oak Ridge National Lab., Tenn.
THE p, n REACTION AT INTERMEDIATE ENERGY
Charles D. Goodman 1979 30 p refs Presented at the Conf. on p,n Reaction and the Nucleon-Nucleon Force, Telluride, Colo., 29 Mar. 1979
(Contract W-7405-eng-26)
(CONF-790348-7) Avail: NTIS HC A03/MF A01

The use of the (p,n) reaction in exploring effective interactions is reviewed. Some recent data on self conjugate nuclei are presented, and the differences between low and high energy data are emphasized. Experimental problems and techniques used are briefly described. It is concluded that forward angle (p,n) spectra at energies greater than 100 MeV are dominated by Gamow-Teller (GT) transitions, while Fermi transitions dominate near 45 MeV. Prominent GT transitions are expected from a pion exchange interaction. DOE

N80-27172# Stanford Linear Accelerator Center, Calif.
PRODUCTION OF RESONANCES IN PHOTON-PHOTON COLLISIONS
Frederick J. Gilman Jan. 1980 18 p refs Presented at the Intern. Conf. on Two-Photon Interactions, Lake Tahoe, Nev., 30 Aug. - 1 Sep. 1979
(Contracts EY-76-C-03-0515; DE-AC03-76SF-00515)
(SLAC-PUB-2461; CONF-7908102-2) Avail: NTIS HC A02/MF A01

The subject of production of resonances via two photons in +e -e colliding beams is discussed. The quark content of these states and or the dynamics of their two photon decays are discussed. The charmonium states, a measurement of the two photon decay widths are presented. At LOP energies the cross sections for production of any particular state are rather small. The pi is examined. A measurement of this coupling is much easier using the complimentary technique. DOE

N80-27173# California Univ., Berkeley. Lawrence Berkeley Lab.
PROCEEDINGS OF THE WORKSHOP ON STOCHASTIC MOLECULAR DYNAMICS. NRCC PROCEEDINGS NO. 6
David Ceperley, ed. and John Tully, ed. 1979 69 p refs Conf. held at Woods Hole, Mass., 8-11 July 1979
(Contract W-7405-eng-48)
(LBL-9510; CONF-790735) Avail: NTIS HC A04/MF A01

Twenty papers are included which discuss methods for incorporating effects of surrounding media and for reducing the number of degrees of freedom by means of stochastic elements in molecular dynamics simulations. Many of the critical problems which currently limit the utility of molecular dynamics, stochastic dynamics, and Monte Carlo simulations were examined. Condensed phase processes, polymer motion, surface chemistry, and gas phase dynamics were explored. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N80-27174# JAYCOR, Alexandria, Va.
INVESTIGATION OF COLLECTION ION ACCELERATION

USING INTENSE RELATIVISTIC ELECTRON BEAMS Final Report, 11 Dec. 1978 - 13 Dec. 1979
Frederick Mako Feb. 1980 30 p refs
(Contract N00173-79-C-0408)
(AD-A081958; JAYCOR-320-80-002-FR) Avail: NTIS HC A03/MF A01 CSCL 20/7

Recently there has been an increased interest in a compact high energy intense light-ion accelerator. Some of the areas of application for such an accelerator include directed energy research, inertial fusion and magnetic fusion. The new approach that has been proposed for investigation is the space charge wave accelerator. With the space charge wave type of collective ion acceleration scheme, one can expect a compact, efficient ion accelerator which is capable of producing high energy and high current ion beams. The ion energy limit occurs when the ion velocity equals that of the electrons. Thus, for an easily producible 1 MeV electron beam about 2 GeV protons are expected. Since a large number of electrons are needed for an intense relativistic electron beam, a proportional but smaller number of ions are expected by momentum balance. With an accelerating electric field having a strength of 1 MV/cm, the 2 GeV proton can be obtained in a short accelerator length of 20 meters. GRA

N80-27175# Rockwell International Corp., Richland, Wash.
RADIOACTIVE LIQUID WASTES DISCHARGED TO GROUND IN THE 200 AREAS DURING 1978
J. D. Anderson and B. E. Poremba 26 Mar. 1979 235 p refs
(Contract EY-77-C-06-1030)
(RHO-CD-78-34-4Q) Avail: NTIS HC A11/MF A01

The radioactive liquid wastes that have been discharged to the ground in the 200 Areas are summarized. In addition to data for 1978, cumulative data since plant startup are presented. Also,a listing of decayed activity to the various plant sites is given. DOE

N80-27178# Exxon Nuclear Idaho Co., Inc., Idaho Falls.
***OVERVIEW OF HIGH-LEVEL WASTE MANAGEMENT* ACCOMPLISHMENTS**
H. Lawroski, J. R. Berreth, and W. A. Freeby 1980 14 p refs Presented at Waste Management Conf., Tucson, Ariz., 10 Mar. 1980
(Contract EX-76-C-07-1570)
(CONF-800313-3) Avail: NTIS HC A02/MF A01

Storage of power reactor spent fuel is discussed in relation to the lack of reprocessing operations particularly in the U.S. By considering the above solidification and storage scenario, there is more than reasonable assurance that acceptable, stable, low heat generation rate, solidified waste can be produced and safely disposed. By maintaining the liquid and solidified high level waste in secure, above ground storage until acceptable decay heat generation rates are achieved, by producing a compatible, high integrity, solid waste form, by providing a second or even third barrier as a compound container and by inserting the enclosed waste form in a qualified repository with spacing to assure moderately low temperature disposal conditions, there appears to be no technical reason for not progressing further the disposal of high level wastes and needed implementation of the complete nuclear power fuel cycle. DOE

N80-27177# Los Alamos Scientific Lab., N. Mex.
SPACE NUCLEAR REACTOR POWER PLANTS
D. Buden, W. A. Ranken, and D. R. Koenig Jan. 1980 33 p refs
(Contract W-7405-eng-36)
(LA-8223-MS) Avail: NTIS HC A03/MF A01

Nuclear power is probably the only source for some deep space missions and a major competitor for many orbital missions, especially those at geosynchronous orbit. Because of the potential requirements, a technology program on space nuclear power plant components was initiated. The missions that are foreseen, the current power plant concept, the technology program plan, and early key results are described. DOE

N80-27176# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT OF ADVANCED CONCEPTS FOR IMPROVED HEAVY WATER PRODUCTION TECHNOLOGY Quarterly report, 1 Oct. - Dec. 1979
F. T. Aldridge, I. P. Herman, J. B. Marling, and L. L. Wood 5 Feb. 1980 31 p refs
(Contract W-7405-eng-48)
(UCID-17736-79-4) Avail: NTIS HC A03/MF A01

During the last quarter, work continued on deuterium separation by metal hydride chromatography and by CO2 laser multiple-photon dissociation (MPD). In the chromatographic process CaBNi4 Cu plus Ni powder mixtures were examined as possible column materials. The photochemical studies centered on further investigation of the quite promising technqiue of MPD of trifluoromethane. DOE

N80-27179# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
DEVELOPMENT OF TAILORED CERAMICS FOR GEOLOGIC STORAGE OF NUCLEAR WASTES Quarterly Progress Report, 1 Oct. - 31 Dec. 1979
15 Feb. 1980 25 p
(Contract DE-AC09-79ET-41900)
(DOE/ET-41900/T1) Avail: NTIS HC A02/MF A01

Tailored ceramics are crystalline assemblages which closely approximate those found in natural minerals and are made by high temperature and pressure consolidation of a nuclear waste with selected additives. The multitask program includes generic and fundamental studies, formulation and consolidation studies, radiation and transmutation effects, and geologic compatibility. Equipment development and process evaluation techniques are included. DOE

N80-27180# Department of Energy, Washington, D. C. Div. of Spent Fuel Storage and Transfer.
SPENT FUEL STORAGE REQUIREMENTS: THE NEED FOR AWAY-FROM-REACTOR STORAGE
Jan. 1980 12 p
(DOE/NE-0002) Avail: NTIS HC A02/MF A01

The away-from-reactor storage requirements estimate published in February 1979 are updated to reflect recent data on reactor operations and spent fuel storage. In addition to the updates of cases representing the range of AFR requirements in DOE/ET-0075, new cases of interest reflecting utility and regulatory trends are presented. DOE

N80-27181# California Univ., Livermore. Lawrence Livermore Lab.
***SOLID STATE TRACK DETECTORS IN THE INERTIAL* CONFINEMENT FUSION PROGRAM AT LLL**
N. M. Ceglio and E. V. Benton (San Francisco Univ.) 30 Jan. 1980 27 p refs Presented at the 10th Intern. Conf. on Solid State Nucl. Track Detectors, Lyon, 2-7 Jul. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-82550-Rev-1; CONF-790765-4) Avail: NTIS HC A03/MF A01

Two recent conference papers on the use of cellulose nitrate and CR-39 to diagnose laser fusion targets are combined with a chronological introduction and update to efforts in this area. DOE

N80-27182# R and D Associates, Marina Del Rey, Calif.
HIGH ENERGY BREMSSTRAHLUNG IN AN INTENSE LASER FIELD
L. Schlessinger and J. A. Wright Feb. 1980 24 p refs
(Contract W-7405-eng-48)
(UCRL-15200; RDA-TR-114000-001) Avail: NTIS HC A02/MF A01

The cross section for bremsstrahlung emission and absorption by electrons in an intense laser field was calculated in the Born approximation for the electron ion potential. Typical numerical results are presented as a function of the ratio of the electron quiver energy to its energy and the ratio of the bremsstrahlung energy to the electron energy. The intense field correction factor for the rate of bremsstrahlung emission and absorption for electrons with a Boltzmann distribution of energies was calculated. Numerical results for the correction factor are presented for the Boltzmann case as a function of the ratio of the electron quiver energy to its thermal energy and the ratio of the

bremsstrahlung energy to the thermal energy. For typical laser fusion parameters, this correction factor which is the ratio of the thermal bremsstrahlung emission rate in the intense laser field to the rate at zero field can be quite significant. DOE

N80-27183# California Univ., Livermore. Lawrence Livermore Lab.
MODELING OF BEAM FOCUSING AND KINK INSTABILITY FOR COLLIDING RELATIVISTIC ELECTRON AND POSITRON BEAMS
William M. Fawley and Edward P. Lee 8 Feb. 1980 23 p refs
(Contracts W-7405-eng-48; N60921-80-WR-W0188; ARPA Order 3718)
(UCID-18584) Avail: NTIS HC A02/MF A01

A simulation code was developed and exercised to study the time evolution and resultant luminosity of intersecting pulses of electrons and positrons. Under the extreme conditions of high current and small radius recently proposed, the pulses mutually pinch to a smaller mean radius than that achieved by free flight alone. The effective luminosity is enhanced by a factor of about 3 in the best case, corresponding to zero initial emittance and pulse length equal 1/4 the mean betatron wavelength. Gaussian profiles in the longitudinal and transverse coordinates are preferred over flat profiles in order to minimize disruptive oscillations in radius which reduce luminosity. A second potential source of disruption is the kink instability. This is always present to some degree during the interaction of opposed pulse. However, the maximum growth rate is only one half the angular betatron frequency and therefore mode growth is limited to a very low level if the pulses are short compared with a betatron wavelength. DOE

N80-27184# Nantes Univ. (France). Lab. de Spectroscopie Nucleaire.
CLASSICAL STUDIES OF THE ELLIPSOIDAL SHAPES FOR DYNAMICAL DEFORMATION THEORIES OF THE NUCLEUS
B. Remaud 1979 36 p refs
(LSNN-78-04) Avail: NTIS HC A03/MF A01

The shape dependent functions of the liquid drop and the droplet models are analytically calculated for an ellipsoid. Using the ellipsoidal symmetries, these functions (including the curvature function) are written in terms of three basic expressions. The nuclear deformation energy can be calculated in a simple way for axially symmetric and asymmetric ellipsoidal nuclei whatever the magnitude of the deformation. Author (ESA)

74 OPTICS

Includes light phenomena.

N80-27185* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CHROMATICALLY CORRECTED VIRTUAL IMAGE VISUAL DISPLAY Patent
William M. Kahlbaum, Jr., inventor (to NASA) Issued 10 Jun. 1980 4 p Filed 23 Oct. 1978
(NASA-Case-Lar-12251-1; US-Patent-4,206,970; US-Patent-Appl-SN-953389; US-Patent-Class-350-175E; US-Patent-Class-350-226) Avail: US Patent and Trademark Office CSCL 20F

An in-line, three element, large diameter, optical display lens is disclosed which has a front convex-convex element, a central convex-concave element, and a rear convex-convex element. The lens, used in flight simulators, magnifies an image presented on a television monitor and, by causing light rays leaving the lens to be in essentially parallel paths, reduces eye strain of the simulator operator.

Official Gazette of the U.S. Patent and Trademark Office

N80-27186# Hughes Research Labs., Malibu, Calif.
FIBER OPTICS DELAY LINE (250 KHz - 250 MHz) Final Report, 15 Mar. - 15 Sep. 1979
C. W. Slayman, H. W. Yen, W. H. Wallace, and R. R. Burns Mar. 1980 50 p
(Contract N00173-79-C-0098)
(AD-A083616) Avail: NTIS HC A03/MF A01 CSCL 20/1

Three stabilized semiconductor laser transmitters, one photodiode-amplifier module, and one 475-m section of optical fiber were packaged for application in a fiber-optic delay line. The design and performance of the transmitter and receiver are presented over a bandwidth of 50 kHz to 350 MHz. The entire system, consisting of a transmitter-fiber-receiver, displays a dynamic range of 30 dB or better and a pulse delay of 2.2 microseconds. The system is flat to + or - 1 dB across the entire band. GRA

N80-27187# Hughes Aircraft Co., Culver City, Calif.
TECHNIQUES FOR FABRICATING HIGH RESOLUTION LIQUID CRYSTAL RETICLES Interim Technical Report, Oct. 1978 - Sep. 1979
Barry C. Gilbert Dec. 1979 54 p
(Contract DAAK10-78-C-0386)
(AD-A083286; HAC-FR-80-72-505; HAC-REF-E1635) Avail: NTIS HC A04/MF A01 CSCL 20/6

The overall objective of this two-phase program was to develop techniques for fabricating high resolution liquid crystal reticles suitable for military application. The first phase of this program consisted of three technology development tasks, namely substrate improvements, liquid crystal seals, and electronic seals. The goal of each development task was successfully accomplished. Results are summarized below: (1) Techniques were developed to produce 98 percent working electrode lines without repair (100 percent with rspair) on LCR plates with a density of 580 lines per inch. Results were verified by optical inspection and electrical test. (2) LC cells fabricated with Ablefilm 539 sealant have now surpassed 7000 hours at -80 C and -17 C without cell deterioration. Additional cells with bulk electrodes and continuous AC voltage have surpassed 6200 hours at -25 C without alignment change. Other cells fabricated with Ablefilm 539 showed no signs of weakening when exposed to liquid nitrogen or boiling water conditions. (3) A dual coating of silicon nitride and parylene demonstrated moisture protection, but the process was costly to apply and difficult to repair. Conventional hybrid solder sealing technology was used to devise two alternate packaging concepts to maximize producibility and maintainability with potentially lower production costs. GRA

N80-27188# Los Alamos Scientific Lab., N. Mex.
FIBER-OPTICS TECHNOLOGY REVIEW
Peter B. Lyons 1980 19 p refs Presented at DNA Symp. on Fiber Optics in the Nucl. Environment, Washington, D.C., 25-27 Mar. 1980
(Contract W-7405-eng-36)
(LA-UR-80-667; CONF-800322-2) Avail: NTIS HC A02/MF A01

A history of fiber technology is presented. The advantages of fiber optics are discussed (bandwidth, cost, weight and size, nonmetallic construction, and isolation). Disadvantages of fiber systems discussed are fiber and cable availability, fiber components, radiation effects, receiver and transmitters, and material dispersion. Development of fibers and systems optimized for use at wavelengths near 1.3 micrometers and development of wavelengths multiplexers for simultaneous system operation at several wavelengths. DOE

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-27189*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
PLASMA PHYSICS ANALYSIS OF SERT-2 OPERATION
Harold R. Kaufman Jan. 1980 59 p refs
(Grant NsG-3011)
(NASA-CR-159814) Avail: NTIS HC A04/MF A01 CSCL 20I

An analysis of the major plasma processes involved in the SERT 2 spacecraft experiments was conducted to aid in the

interpretation of recent data. A plume penetration model was developed for neutralization electron conduction to the ion beam and showed qualitative agreement with flight data. In the SERT 2 configuration conduction of neutralization electrons between thrusters was experimentally demonstrated in space. The analysis of this configuration suggests that the relative orientation of the two magnetic fields was an important factor in the observed results. Specifically, the opposed field orientation appeared to provide a high conductivity channel between thrusters and a barrier to the ambient low energy electrons in space. The SERT 2 neutralizer currents with negative neutralizer biases were up to about twice the theoretical prediction for electron collection by the ground screen. An explanation for the higher experimental values was a possible conductive path from the neutralizer plume to a nearby part of the ground screen. Plasma probe measurements of SERT 2 gave the clearest indication of plasma electron temperature, with normal operation being near 5 eV and discharge only operation near 2 eV. E.D.K.

N80-27190# Toronto Univ., Downsview (Ontario). Institute for Aerospace Studies.

A STUDY OF THE CHARACTERISTICS OF AN ATMOSPHERIC PRESSURE MICROWAVE-INDUCED ARGON PLASMA

S. K. Wong May 1980 62 p

(UTIAS-TN-225; CN-ISSN-0082-5263) Avail: NTIS HC A04/MF A01

A microwave induced argon plasma is produced at atmospheric pressure in a capacity loaded resonant cavity operated at 2450 MHz and 100 to 300 watts. Plasma parameters such as electron temperature and electron density are measured spectroscopically under various argon flow rates and power inputs to the cavity. The gas translational temperature of the plasma is estimated by measuring the rotational temperature of C2 molecules, this is done by mixing 5% of methane by volume with the argon gas. The general characteristics of the microwave induced argon plasma as a possible ion source for mass spectroscopy are studied. E.D.K.

N80-27191# Colorado Univ. at Boulder. Dept. of Astro-Geophysics.

PLASMA WAVE TURBULENCE AND PARTICLE HEATING CAUSED BY ELECTRON BEAMS, RADIATION AND PINCHES Final Report, 1 Aug. 1976 - 1 Oct. 1979

Martin V. Goldman Nov. 1979 528 p refs Submitted for publication

(Contract F49620-76-C-0005; AF Proj. 2301)

(AD-A081883; CU-1036; AFOSR-80-0167TR) Avail: NTIS HC A23/MF A01 CSCL 20/9

For electron beams, a theory of the dynamics of driven Langmuir wave turbulence was developed. In low density beams, Langmuir wave evolution was found to be governed by nonlinear index of refraction effects, and associated self-focusing, rather than by wave reaction back on the beam. In laser-plasma interactions, the nonlinear theoretical work was verified experimentally in collaboration with Dr. N. Peacock of Culham Laboratories. In an experiment on nonlinear interactions of a carbon dioxide laser with a dense plasma focus device, almost 100 percent anomalous absorption of the radiation was observed along with intense Langmuir turbulence. The results were published in Physical Review Letters. A classical theory of the Raman-induced Kerr effect was developed. A computer code was developed to help determine plasma temperatures, radiation, impurity distributions, and overall plasma evolution in Z-pinch plasmas. GRA

N80-27192# STD Research Corp., Arcadia, Calif.

OPEN-CYCLE MHD SYSTEMS ANALYSIS Final Report

R. A. Harvey, C. D. Maxwell, J. L. Miller, and S. T. Demetriades Nov. 1979 156 p refs Sponsored by Electric Power Research Inst.

(EPRI-AF-1230) Avail: NTIS HC A08/MF A01

The power plant performance and economic characteristics of six open cycle magnetohydrodynamics (MHD) power plant options are investigated: four with directly fired air preheaters, one with separately fired air preheaters, and one using oxygen enrichment. Using the directly fired options, the effects of high sulfur Eastern coal and low sulfur Western coal, sulfur emissions control by seed regeneration and by wet limestone scrubbers, and slag removal performance in the MHD combustor unit are compared. Critical components requiring further development are identified. DOE

N80-27193# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.

PERFORMANCE ANALYSES OF ELMO BUMPY TORUS PLASMAS AND PLASMA SUPPORT SYSTEMS

Max E. Fenstermacher 31 Dec. 1979 110 p refs Prepared for Westinghouse Elec. Corp., Pittsburgh

(Contract EG-77-C-02-4231)

(WFPS-TME-79-030) Avail: NTIS HC A06/MF A01

The development and application of the OASIS Code (operational analysis of ELMO bumpy torus support and ignition systems) for the study of ELMO bumpy torus (EBT) device and plasma performance are presented. The code performs a time independent, zero dimensional, self consistent calculation of plasma and plasma support systems parameters for the physics and engineering of EBT devices. The features of OASIS modeling for the EBT plasma include: (1) particle balance of the bulk toroidal and electron ring plasma components for experimental as well as reactor devices; (2) energy balance in the bulk and ring plasmas for externally heated or ignition devices; (3) alpha particle effects for reactor devices; (4) auxiliary heating effects, including microwave RF heating and neutral beam methods; and (5) ignition conditions, including fusion power, alpha power, and neutron wall loading. DOE

N80-27194# Oxford Univ. (England). Dept. of Engineering Science.

ELECTRON BEAM SCATTERING IN PARTIALLY IONIZED GASES

Denis R. Gross Mar. 1979 117 p refs

(Contract AT/2057/042)

(OUEL-1283/79) Avail: NTIS HC A06/MF A01

The scattering of a tenuous (10 to the minus 10th power amps) medium energy (10-30 KeV) electron beam in a partially ionized gas was investigated with a view to developing a diagnostic for weakly ionized low density gas flows. An electron beam 100 microns in diameter was passed through a hollow cathode discharge in a direction parallel to the axis of the cylindrical cathode. The discharge occurred in helium and argon gases at pressures between 0.3 and 2.0 torr. Maintaining the electron beam current at 10 to the minus 10th power amps ensured that any collective interaction between the beam and the plasma would be negligible in comparison with the collisional interaction. Beam profile results were in fair agreement with Langmuir probe results taken in the same discharge. Typically, ion densities of the order of 3 x 10 to the 17th power per cu ware found. It is concluded that the electron beam constitutes a valid diagnostic for measurements of charged particle density, and that the correctness of the theories of multiple scattering in plasma is indicated. Author (ESA)

N80-27195# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.

A PROGRAM TO SOLVE ROTATING PLASMA PROBLEMS

M. Bakker and M. S. vandenBerg (FOM Inst. voor Atoom- en Molecuulfysica) Aug. 1979 39 p refs Submitted for publication

(MC-NW-70/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 5

It is shown that the solution of a rotating plasma problem minimizes a suitably chosen functional. The variational problem is solved by means of the Ritz-Galerkin method using piecewise bilinear functions and applying Newton-Cotes-like quadrature. The resulting linear system with sparse non-negative definite matrix is solved by an adaptive conjugate gradient method. A documented FORTRAN program is presented for solving the elliptic boundary problem. Author (ESA)

N80-27196# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.

DIAGNOSTICS AND SIMULATION OF THE INITIAL IONIZATION IN NaCl-CONTAMINATED ARGON PLASMA

C.-P. Schneider and G. Hahne (Hochschule der Bundeswehr, Munich) 17 Jul. 1979 19 p refs

(MBB-UA-498-79Oe) Avail: NTIS HC A02/MF A01

A method for cleaning shock tubes was investigated which involves glass bead peening of the shock-tube walls followed by multiple flushing of the tube. This method, however, left a practically irreducible and non-negligible residue of sodium chloride vapor in the tube. The observed time dependence of the electron density, the electron temperature, and the emitted sodium D light, in shock-heated argon contaminated by a small amount of sodium chloride vapor was simulated theoretically. It was found that accounting for the effects of contaminants requires important revisions in rate constants for pure argon from previously determined values. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-27197*# National Aeronautics and Space Administration, Washington, D. C.

CHARACTERIZATION AND GROWTH OF EPITAXIAL LAYERS OF Gs EXHIBITING HIGH RESISTIVITY FOR IONIC IMPLANTATION

Dec. 1979 91 p refs Transl. into ENGLISH of Final Report (Limeil-Brevannes, France), LEP-79/19, SME-441-H and DGRST-76-7-0067, Dec. 1977 p 1-90 Translation was announced as N79-24881 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Lab. D'Electronique et de Physique Appliquee, LimeilBrevannes, France

(Contract NASw-3198)

(NASA-TM-75747; LEP-79/19; SME-441-H; DGRST-76-7-0067) Avail: NTIS HC A05/MF A01 CSCL 20L

Either classical or low temperature epitaxial growth techniques can be used to control the deposition of buffer layers of GaAs on semiconducting substrates and to obtain the resistivity and purity desired. Techniques developed to study, as a function of thickness, the evolution of mobilities by photoHall, and the spectroscopy of shallow and deep centers by cathodoluminescence and current transients reveal one very pure layer of medium resistivity and high mobility, and another 'dead layer' of elevated resistivity far from the surface. The highly resistive layer remains pure over several microns, which appears interesting for implantation. A.R.H.

N80-27198# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.

GaAs MONOLITHIC MICROWAVE SUBSYSTEM TECHNOLOGY BASE Technical Report, 30 Sep. 1978 - Sep. 1979

J. G. Oakes and J. E. Degenford Jan. 1980 242 p refs

(Contract N00014-78-C-0268; DARPA Order 3543)

(AD-A083613; Rept-80-0077; NR-251-029-10) Avail: NTIS HC A11/MF A01 CSCL 09/5

During the period covered by this report, a number of decisions on GaAs material growth and processing, improvements in device design, and changes in device and circuit fabrication were made. In addition, all of the required processing fabrication and measurement equipment has become fully operational. The above, in turn, have resulted in: (1) increased yields of FET devices, (2) more uniform DC and RF characteristics, (3) improved FET performance as demonstrated by substantially higher output power per unit of gate width and higher power added efficiency, and (4) a faster program pace as manifested by more device and monolithic circuit processing runs per unit time. The benefits of the Melbourn Liquid Encapsulated Czochralski facility are becoming evident as large diameter, low impurity GaAs boules grown in pyrolitic boron nitride crucibles are available and being used in this program. Measurements of mobilities have shown values close to the theoretical limit for the case of a zero background impurity level, i.e., a mobility of 5500 for n = 5 x 10 to the 16th power. GRA

N80-27199# Hughes Research Labs., Malibu, Calif.

GALLIUM ARSENIDE ADVANCED CRYSTAL GROWTH AND BEAM PROCESSING Final Progress Report, 1 May 1978 - 30 Jul. 1979

C. L. Anderson Jan. 1980 133 p refs

(Contract N00014-78-C-0337; ARPA Order 3564)

(AD-A083096) Avail: NTIS HC A07/MF A01 CSCL 20/2

This report describes the progress made during a fifteen month program to study the feasibility of growth of high purity epitaxial quality bulk GaAs crystals from solution and annealing of implanted layers and Ohmic contacts for device applications using laser and electron beams. Millimeter-thick crystals have been grown by the low-temperature solution-growth process. Room-temperature n-type carrier concentrations of 2 times 10 to the 15th power/cu cm and liquid nitrogen mobilities of 30,000 sq cm/V/sec have been achieved. Theoretical studies of a variety of potential growth configurations were performed. A detailed study of the laser of annealing implanted layers and Ohmic contacts was performed using several Q-switched and cw lasers. State-of-the-art results were achieved in both the implant-annealing and Ohmic-contact areas. Preliminary investigations of the annealing of implanted layers and Ohmic contacts using pulsed electron beams were also performed. GRA

N80-27200# Cornell Univ., Ithaca, N. Y. Materials Science Center.

ELECTRON DIFFRACTION AND MICROSCOPY STUDIES OF THE STRUCTURE OF GRAIN BOUNDARIES IN SILICON

C. B. Carter, H. Foell, D. G. Ast, and S. L. Sass Feb. 1980 42 p refs

(Contract EY-76-S-02-2899)

(COO-2899-T2; MSC-4151) Avail: NTIS HC A03/MF A01

The diffraction effects expected from the periodic structure of twist boundaries in Si were determined by an examination of the reciprocal lattice of these boundaries. Methods of analysis were developed to distinguish between the real diffraction spots due to the periodic boundary structure and those due to double diffraction effects. The electron microscope images for the boundaries studied in Si bicrystals frequently were complex and contained Moire fringes which provided no imformation on the actual boundary structure. By analyzing the electron diffraction patterns from these boundaries for the presence of new diffraction spots it was possible to show that all the sigma 1/001/, sigma 1/111/, sigma 3/111/ twist boundaries examined have a periodic structure. DOE

N80-27201# Stanford Linear Accelerator Center, Calif.

ELECTRON TRAJECTORY PROGRAM

William B. Herrmannsfeldt Nov. 1979 119 p refs

(Contract EY-76-C-03-0515; DE-AC03-76SF-00515)

(SLAC-226) Avail: NTIS HC A06/MF A01

SLAC electron trajectory program is described and instructions and examples for users are given. The program is specifically written to compute trajectories of charged particles in electrostatic and magnetostatic focusing systems including the effects of space charge and self-magnetic fields. Starting options include Child's Law conditions on cathodes of various shapes. Either rectangular on cylindrically symmetric geometry may be used. Magnetic fields may be specified using arbitrary configurations of coils, or the output of a magnet program such as Poisson or by an externally calculated array of the axial fields. The program is available in IBM FORTRAN but can be easily converted for use on other brands of hardware. The program is intended to be used with a plotter whose interface the user must provide. DOE

N80-27202# Northwestern Univ., Evanston, Ill.

INVESTIGATION OF DEEP LEVEL DEFECTS IN EPITAXIAL SEMICONDUCTING ZINC SULPHO-SELFNIDE Progress Report, 15 Jun. 1979 - 14 Jun. 1980

B. W. Wessels 1980 33 p

(Contract DE-AC02-79ER-10390)

(DOE/ER-10390) Avail: NTIS HC A03/MF A01

In an effort to understand the defect structure of the ternary 2-6 compound zinc sulpho-selenide, the binary compound zinc selenide was investigated. Thin single crystalline films of zinc selenide were heteroepitaxially grown on (100) GaAs. Epitaxial layers from 5 to 50 microns thick could be readily grown using a chemical vapor transport technique. The layers had an excellent morphology with few stacking faults and hillocks. Detailed epitaxial growth kinetics were examined as a function of temperature

and reactant concentration. It was found that hydrogen flow rate, source and substrate temperature affect the growth rate of the epitaxial films. Au - ZnSe Schottky barrier diodes and ZnSe - GaAs n-p heterojunctions were prepared from the epitaxial layers. Current-voltage characteristics were measured on both types of diodes. From capacitance-voltage measurements the residual doping density of the epitaxial layers were found to be of the order of 10 to the 14th power to 10 to the 15th power/cu cm. Finally, the deep level spectrum of both the Schottky barrier diodes and the heterojunctions are being measured. Deep level transient spectroscopy appears to be well suited for determining trapping states in ZnSe provided the material has a low enough resistivity. DOE

N80-27203# General Electric Co., Schenectady, N. Y.
INFLUENCE OF PHASE BOUNDARIES OF PHOTOINDUCED ELECTRON TRANSFER REACTIONS Final Report, 1 Jul. 1977 - 31 Aug. 1979
George L. Gaines, Jr. Aug. 1979 9 p refs
(Contract EG-77-C-02-4395)
(COO-4395-1) Avail: NTIS HC A02/MF A01

A summary is presented of results of research which was conducted on bipyridyl complexes of ruthenium, with the objective of storing visible light energy. The research covered analytical techniques, synthesis, properties of Ru complexes in monolayers and micelles, and luminescence quenching. DOE

N80-27204# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbleiter.
ADVANCED ION IMPLANTATION TECHNIQUES Final Report
Arno Kostka and Wilfried Quast Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 72 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. (BMFT-FB-T-79-37) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 14,70

Three different applications of ion implantation techniques were developed and tested for their production compatibility. The implantation of gold ions into the back of diode wafers allowed a more precise control of reverse recovery times than with conventional methods. The implantation of boron ions into the region near the surface of pnp transistors suppressed effects caused by inversion of the collector zone. Using the lateral component during diffusion from implanted sources, HF MOSFETS were fabricated with very small channel lengths.
Author (ESA)

N80-27205# Bureau of Mines, Avondale, Md.
METHODOLOGY FOR EVALUATING INTEGRAL GAUSSIAN PROFILES
Arthur B. Campbell 1980 24 p refs
(PB80-158595; BM-IC-8811) Avail: NTIS HC A02/MF A01 CSCL 20L

A method that uses a computer program to evaluate integral Gaussian profiles of atomic concentration versus depth in a solid is described. The specific use illustrated involves profiling ion implanted metals using proton induced X-ray emission analysis and ion sputtering for sectioning. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N80-27206# Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.
AN ANALYSIS OF THE IRREVERSIBLE THERMODYNAMICS MODEL FOR COUPLED HEAT AND MOISTURE TRANSPORT PHENOMENA IN UNSATURATED POROUS MEDIA
J. A. Havens 1980 125 p refs
(PB80-149321; PUB-67; WB0-03639; OWRT-A-042-ARK(2))
Avail: NTIS HC A06/MF A01 CSCL 20M

An irreversible thermodynamics based model for the description of coupled heat and moisture transfer was analyzed. The transport coefficients appearing in the model equations were independently determined, and the equations were numerically integrated to predict temperature and moisture content profiles for a closed system of water unsaturated glass beads. An experimental investigation of the moist glass beads medium provided measurements of steady state profiles of local temperatures and moisture content. These data when compared with model predictions, indicated the validity of the irreversible thermodynamics approach. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-27207# Environmental Law Inst., Washington, D. C.
ENERGY-EFFICIENT PROCUREMENT IN STATE AND LOCAL GOVERNMENTS
Joe W. Russell, Jr. Jul. 1979 70 p refs
(Contract EM-78-C-01-5255)
(DOE/CS-5255/1) Avail: NTIS HC A04/MF A01

State and local governments have been slow in preparing and implementing plans for energy conservation with respect to the development of energy efficient standards and policies. This lack of compliance with the Energy Policy and Conservation Act is due to a lack of reliable information on many energy-consuming products, a resistance to change on the part of purchasing officials to their superiors, and reluctance in the tax revolt era to spend money in order to save money and energy as well. To overcome these obstacles, states and localities should consider mandating energy-efficient procurement pratices through either executive orders or legislation. In addition, states and localities should consider adopting institutional arrangements, such as centralized purchasing and joint or cooperative purchasing that will facilitate energy-efficient procurement. Life cycle costs should be considered as bid evaluation criterion. To further state and local efforts in this area, the federal government should provide technical and financial assistance to an organization of purchasing officials to establish an information clearinghouse.
A.R.H.

N80-27208# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
QA MANAGEMENT APPROACH UNIQUE TO R AND D PROGRAMS
R. J. Beaver and J. R. Weir, Jr. 1980 7 p Presented at the 34th Ann. Tech. Conf. of the Am. Soc. for Quality Control, Atlanta, 20 May 1980
(Contract W-7405-eng-48)
(CONF-800505-1) Avail: NTIS HC A02/MF A01

The approach to the current quality assurance management of the Metals and Ceramics Division at ORNL is discussed. The organization disciplines interrelate with the QA programming. Procedure QA-MC-1-100 defines control of experimental tasks, which represent about 90% of the Division's work. Procedure QA-MC-1106 defines action plans for projects. The QA coordinator, independent of line management, communicates, audits, and reviews to assist line management in the understanding and acceptance of the Division QA procedures. DOE

N80-27209# Office of Personnel Management, Washington, D.C. Personnel Research and Development Center.

THE DESIGN AND DEVELOPMENT OF AN INTERORGANIZATIONAL PERFORMANCE EVALUATION AND REFERRAL SYSTEM Final Report
Charles N. MacLane Aug. 1979 39 p refs
(PB80-151012; TM-79-19) Avail: NTIS HC A03/MF A01 CSCL 05I

There has been an increasing recognition that performance appraisal (PA) research should begin from open-systems assumptions. Evidence supporting this view comes from studies showing that contextual variables such as change in organizational setting, rater organizational level, and composition of subordinate work group may explain useful amounts of variance in PA outcomes. In view of these findings, the development of valid and reliable PA instruments for inter-organizational use presents some methodological problems. The development of such a system incorporating a behavioral expectation scale approach which generates measures of the equivalency of performance behavior domains and performance standards across organizations is described. GRA

N80-27249# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE IMPORTANCE OF THE LONG-TERM PLANNING OF THE EUROPEAN SPACE AGENCY FOR SPACE RESEARCH IN THE FEDERAL REPUBLIC OF GERMANY
K. Pinkau *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p. 219-232 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-98)
Avail: NTIS HC A12/MF A01

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-27210# Calculon Corp., Philadelphia, Pa.
DISTRIBUTED DATA BASE TECHNOLOGY STATE-OF-THE-ART REVIEW Final Technical Report, Mar. 1978 - Sep. 1979
Griffiss AFB, N.Y. RADC Feb. 1980 80 p refs
(Contract F30602-78-C-0113; AF Proj. 4594)
(AD-A082037; RADC-TR-80-7) Avail: NTIS HC A05/MF A01 CSCL 09/2

This document provides theoretical information relating to the development of information systems where large data bases are utilized. The study considers the problems associated with the construction, implementation and maintenance of those data bases in a distributed processing environment. The data base management systems, data communications networking and the utilization of multi-processor configurations are also included in the investigation. Four specific problem areas of the update function under the distributed concept were studied and are reported upon. They are data integrity, logging and recovery, deadlock and security. GRA

N80-27211# Instituut TNO voor Wiskunde, Informatieverwerking en Statistiek, The Hague (Netherlands).
A LOOSE BUT INDULGENT RETRIEVAL STRATEGY FOR COMPUTERS [EEN SLORIDGE MAAR TOEGEEFIJKE ZOEKSTRATEGIE VOOR COMPUTERS]
T. deHeer Mar. 1978 20 p refs In DUTCH; ENGLISH summary
Avail: NTIS HC A02/MF A01

A retrieval system design is described in which information records consisting of pieces of natural language are attached to each other, leaving fuzzy semantic traces behind in the form of sets of three letter strings which have been derived from the original texts. The system calculates an 'importance value' for each possible answer to a user query. Queries also may be given in the form of a simple piece of natural language. Answers are communicated to the user, if he so wishes, in descending order of 'importance value' as calculated by the system.
Author (ESA)

N80-27100# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
COMPUTERIZED LITERATURE SEARCHING IN THE GEOGRAPHIC SCIENCES [LITERATUUR ZOEKEN MET DE COMPUTER, IN HET BIJZONDER BIJ DE GEOGRAFISCHE WETENSCHAPPEN]
Piet Tielman *In its* The Computer in Phys. Geograph. 1979 p 63-89 refs In DUTCH (For primary document see N80-27096 17-59)
Avail: NTIS HC A06/MF A01

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-27212 Societe Nationale Industrielle Aerospatiale, Paris (France). Direction Centrale Industrielle.
VALUE ANALYSIS FOR THE AIRCRAFT AIRBUS [L'ANALYSE DE LA VALEUR DANS UN PROGRAMME INTERNATIONAL]
Robert Tassinari 1979 34 p In FRENCH Presented at Soc. of Am. Value Eng. Intern. Conf. on Save Proc., Vol. 19, 1979
(SNIAS-792-501-105) Avail: NTIS HC A03

The implementation of an agreement among Germany, England, France, Netherlands, and more recently, Spain, to develop a transport aircraft is discussed with emphasis on the economic and technical aspects involved. The method in which the various tasks were assigned and performed is described. Project and value engineering considerations are reviewed as well as the factors determining the choice of materials and the methods for optimizing the system. The management of modification procedures is described and some value analysis examples are included. A.R.H.

N80-27213*# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
AN INQUIRY INTO THE HOUSEHOLD ECONOMY
Ralph D. Samuelson Oct. 1979 68 p refs
(Contract NASw-3204)
(NASA-CR-163280; SU-22) Avail: NTIS HC A04/MF A01 CSCL 05C

The value of the time which people devote to each activity of their lives is compared with the money they spend on the activity. After tax wage rates are used to value an individual's time. The enormous size of the household economy and the fact that for most activities the value of the consumer's time devoted to an activity exceeds the money expenditures on the activity, suggest that there are many opportunities for productivity improvements in the household economy which have been overlooked in most traditional thinking on productivity. E.D.K.

N80-27214*# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
ECONOMIC ASPECTS OF SPECTRUM MANAGEMENT
Robert D. Stibolt Oct. 1979 43 p refs
(Contract NASw-3204)
(NASA-CR-163279; SU-25) Avail: NTIS HC A03/MF A01 CSCL 05C

Problems associated with the allocation of the radio frequency spectrum are addressed. It is observed that the current method very likely does not allocate the resource to those most valuing its use. Ecomonic criteria by which the effectiveness of resource allocation schemes can be judged are set forth and some thoughts on traditional objections to implementation of market characteristics into frequency allocation are offered. The problem of dividing orbit and spectrum between two satellite services sharing the same band but having significantly different system characteristics is discussed. The problem is compounded by the likelihood that one service will commence operation much sooner than the other. Some alternative schemes are offered that, within proper international constraints, could achieve a desired flexibility

in the division of orbit and frequency between the two services domestically over the next several years. E.D.K.

N80-27215*# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
THE ECONOMIC BASIS FOR NATIONAL SCIENCE AND TECHNOLOGY POLICY
Donald A. Dunn Oct. 1979 39 p refs
(Contract NASw-3204)
(NASA-CR-163290; SU-23) Avail: NTIS HC A03/MF A01 CSCL 05C

National science and technology policy is concerned with societal choices with respect to the rate and directions of technological change and the adoption and use of new technology in society. Such policy choices occur primarily in connection with management of the creation, dissemination, and use of scientific and technical information. Two categories of policy instruments discussed are market-oriented approaches, and direct public action. Possibilities for increased use of market-oriented approaches that can provide benefits to society in the form of an increased rate of innovation and of more 'appropriate' technology, better suited to the needs of consumers are indicated. A.R.H.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-27216# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1981, PART 2
Washington GPO 1980 509 p Hearings on S. 2238 and S. 2240 before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci., and Transportation, 96th Congr., 2nd Sess., 6-7 and 20 Feb. 1980
(GPO-58-741) Avail: Subcomm. on Sci., Technol. and Space

Funding requests to support research and development, construction and of facilities and program management are justified in testimony delivered and responses to questions asked during a 6 day hearing period. Particular emphasis is given to the supplemental funds needed to support development and evaluation of space shuttle components, as well as to plans for the Galileo Project and Spacelab experiments. Accomplishments and plans are reviewed for the following areas: space science, space transportation system, astronaut program, energy programs, technology utilization, space and terrestrial applications, international affairs, aeronautics, space research and technology, and tracking and data systems. Employment policies are also examined. A.R.H.

N80-27217# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1981
Washington GPO 1980 631 p Hearings on S. 2238 and S. 2240 before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci. and Transportation, 96th Congr., 2nd Sess., 21, 27, and 29 Feb. and 3 Apr. 1980
(GPO-59-779) Avail: Subcomm. on Sci., Technol. and Space

The capabilities, benefits, and transfer of aerospace technology are considered with particular emphasis on remote sensing, space manufacturing, resources management, and environmental monitoring. Fundamental research and technology in aerodynamics, materials and structures, aeronautical propulsion, avionics, and human factors is described as well as accomplishments and advances in space technology. Cooperation with DOE, DOD, and NOAA is highlighted. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.*

N80-27218# Centec Corp., Fort Lauderdale, Fla.
COMPUTER TECHNOLOGY CAN ENHANCE INDUSTRIAL ENERGY EFFICIENCY
1979 38 p refs
(Contract EX-76-C-01-2123)
(DOE/CS-2123/T1) Avail: NTIS HC A03/MF A01

Computer applications that have potential for minimizing energy consumption are discussed. An overview of the current level of computer technology and terminology as it applies to the process industry is given. Emphasis is placed on energy conservation and the use of more energy efficient process equipment. J.M.S.

N80-27219*# National Aeronautics and Space Administration, Washington, D. C.
LESSONS OF THE NASA TECH HOUSE
Howard Allaway 1980 41 p Original contains color illustrations
(NASA-SP-442; LC-80-607024) Avail: NTIS MF A01; SOD HC $3.00 CSCL 13B

The performance and effectiveness of the various systems incorporated into the NASA Technology House are described and evaluated in relation to the HUD reference house. The various aerospace technologies used (advanced electronics, solar energy utilization, water recycling, fire retardant materials) are discussed as well as the improved materials, design configurations, and construction techniques developed under other government programs and by industry. Tabular data show the consumption and conservation of electrial energy and water for each month over one full weather cycle, during which time a family of four was in residence. A.R.H.

N80-27220# Geological Survey, Washington, D. C.
TRANSFERRING EARTH SCIENCE IN FORMATION TO TO DECISIONMAKERS: PROBLEMS AND OPPORTUNITIES AS EXPERIENCED BY THE UNITED STATES GEOLOGICAL SURVEY
Thomas F. Bates 1979 35 p refs
(Circ-813; LC-79-600138) Avail: NTIS HC A03/MF A01

The experiences of the U.S. Geological Survey scientists in interfacing with members of the land use planning and decision making community are reported along with the experiences at the producer-user interface. It is concluded that areas throughout the Nation must be identified and those needs must be continuously reassessed. Effective working relationships between the Earth scientists and the users must be established. F.O.S.

N80-27221*# Stanford Univ., Calif. Dept. of Engineering Economic Systems.
GOVERNMENT PATENT POLICY: AN ANALYSIS OF THE EFFECTS OF THREE ALTERNATIVE PATENT POLICIES ON TECHNOLOGY OF GOVERMENT INVENTIONS
Mark Matousek Oct. 1979 39 p refs
(Contract NASw-3204)
(NASA-CR-163283; SU-27) Avail: NTIS HC A03/MF A01 CSCL 05B

The effects of present and proposed Government patent policies on the process of technology transfer and the commercialization of inventions resulting from Government sponsored research are addressed. The function of the patent system in Government research and the value of patents resulting from government sponsored research are examined. Three alternative patent policies, title in the contractor, title in the Government, and the waiver policy, are examined in terms of their effect on the commercialization of inventions, industrial competitions, disclosure of inventions, participation of research contractors and

administrative costs. Efforts to reform the present Government patent policy are also described. J.M.S.

N80-27222*# South Coast Technology, Inc., Santa Barbara, Calif.
THE NEAR-TERM HYBRID VEHICLE PROGRAM, PHASE 1 Final Report
10 Sep. 1979 153 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-955189)
(NASA-CR-163034; JPL-9950-355) Avail: NTIS HC A08/MF A01 CSCL 13F

Performance specifications were determined for a hybrid vehicle designed to achieve the greatest reduction in fuel consumption. Based on the results of systems level studies, a baseline vehicle was constructed with the following basic parameters: a heat engine power peak of 53 kW (VW gasoline engine); a traction motor power peak of 30 kW (Siemens 1GV1, separately excited); a heat engine fraction of 0.64; a vehicle curb weight of 2080 kg; a lead acid battery (35 kg weight); and a battery weight fraction of 0.17. The heat engine and the traction motor are coupled together with their combined output driving a 3 speed automatic transmission with lockup torque converter. The heat engine is equipped withe a clutch which allows it to be decoupled from the system. A.R.H.

N80-27223*# South Coast Technology, Inc., Santa Barbara, Calif.
MISSION ANALYSIS AND PERFORMANCE SPECIFICATION STUDIES REPORT, APPENDIX A
25 Jan. 1979 177 p refs Sponsored by NASA Prepared for JPL Prepared in cooperation with Gen. Res. Corp., Santa Barbara, Calif.
(Contract JPL-955189)
(NASA-CR-163035; JPL-9950-355) Avail: NTIS HC A09/MF A01 CSCL 13F

The Near Term Hybrid Passenger Vehicle Development Program tasks included defining missions, developing distributions of daily travel and composite driving cycles for these missions, providing information necessary to estimate the potential replacement of the existing fleet by hybrids, and estimating acceleration/gradeability performance requirements for safe operation. The data was then utilized to develop mission specifications, define reference vehicles, develop hybrid vehicle performance specifications, and make fuel consumption estimates for the vehicles. The major assumptions which underlie the approach taken to the mission analysis and development of performance specifications are the following: the daily operating range of a hybrid vehicle should not be limited by the stored energy capacity and the performance of such a vehicle should not be strongly dependent on the battery state of charge. E.D.K.

N80-27224*# South Coast Technology, Inc., Santa Barbara, Calif.
DESIGN TRADEOFF STUDIES AND SENSITIVITY ANALYSIS, APPENDIX B
25 May 1979 251 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-955189)
(NASA-CR-163036; JPL-9950-355-App-B) Avail: NTIS HC A12/MF A01 CSCL 13F

Further work was performed on the Near Term Hybrid Passenger Vehicle Development Program. Fuel economy on the order of 2 to 3 times that of a conventional vehicle, with a comparable life cycle cost, is possible. The two most significant factors in keeping the life cycle cost down are the retail price increment and the ratio of battery replacement cost to battery life. Both factors can be reduced by reducing the power rating of the electric drive portion of the system relative to the system power requirements. The type of battery most suitable for the hybrid, from the point of view of minimizing life cycle cost, is nickel-iron. The hybrid is much less sensitive than a conventional vehicle is, in terms of the reduction in total fuel consumption and resultant decreases in operating expense, to reductions in vehicle weight, tire rolling resistance, etc., and to propulsion system and drivetrain improvements designed to improve the brake specific fuel consumption of the engine under low road load conditions. It is concluded that modifications to package the propulsion system and battery pack can be easily accommodated within the confines of a modified carryover body such as the Ford Ltd. E.D.K.

N80-27225*# South Coast Technology, Inc., Santa Barbara, Calif.
DESIGN TRADEOFF STUDIES AND SENSITIVITY ANALYSIS, APPENDICES B1 - B4
25 May 1979 190 p Sponsored by NASA Prepared for JPL
(Contract JPL-955189)
(NASA-CR-163037; JPL-9950-355-App-B1-B4) Avail: NTIS HC A09/MF A01 CSCL 13F

Documentation is presented for a program which separately computes fuel and energy consumption for the two modes of operation of a hybrid electric vehicle. The distribution of daily travel is specified as input data as well as the weights which the component driving cycles are given in each of the composite cycles. The possibility of weight reduction through the substitution of various materials is considered as well as the market potential for hybrid vehicles. Data relating to battery compartment weight distribution and vehicle handling analysis is tabulated. A.R.H.

N80-27226*# South Coast Technology, Inc., Santa Barbara, Calif.
PRELIMINARY DESIGN DATA PACKAGE, APPENDIX C
25 Jul. 1979 239 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-955189)
(NASA-CR-163038; JPL-9950-355-App-C) Avail: NTIS HC A11/MF A01 CSCL 13F

The data and documentation required to define the preliminary design of a near term hybrid vehicle and to quantify its operational characteristics are presented together with the assumptions and rationale behind the design decisions. Aspects discussed include development requirements for the propulsion system, the chassis system, the body, and the vehicle systems. Particular emphasis is given to the controls, the heat engine, and the batteries. A.R.H.

N80-27227*# South Coast Technology, Inc., Santa Barbara, Calif.
PRELIMINARY DESIGN DATA PACKAGE, APPENDICES C1 AND C2
25 Jul. 1980 202 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-955189)
(NASA-CR-163039; JPL-9950-355-App-C1; JPL-9950-355-APP-C3) Avail: NTIS HC A10/MF A01 CSCL 13F

The HYBRID2 program which computes the fuel and energy consumption of a hybrid vehicle with a bi-modal control strategy over specified component driving cycles is described. Fuel and energy consumption are computed separately for the two modes of operation. The program also computes yearly average fuel and energy consumption using a composite driving cycle which varies as a function of daily travel. The modelling techniques are described, and subroutines and their functions are given. The composition of modern automobiles is discussed along with the energy required to manufacture an American automobile. The energy required to scrap and recycle automobiles is also discussed. F.O.S.

N80-27228# Committee on Science and Technology (U. S. House).
ANALYSIS AND COMMENTARY ON THE FIRST ANNUAL SCIENCE AND TECHNOLOGY REPORT
Dorothy M. Bates, Mary Mogee, and Robert Chivak Washington GPO 1979 128 p refs Rept. presented to the Subcomm. on Library of Congress Sci., Res. and Technol., 96th Congr., 1st Sess., Nov. 1979 Prepared by Congressional Research Service, Library of Congress
(GPO-56-097) Avail: Subcomm. on Sci. Res. and Technol.

The requirement that the President transmit to Congress an annual Science and Technology Report was a congressional initiative which was with the signing of the National Science and Technology Policy, Organization and Priorties Act of 1976. An analysis and commentary on the first Science and Technology Report is presented. The commentary considers the legislative

history of the requirement and the extent to which the report met the congressional intent as well as the substantive content of the report. The annual requirement was shown to be a normal congressional requirement. Following this, various proposals for the preparation of an annual science and technology report which were made in the 1965-1974 period were reviewed, including those of several individuals, two congressional subcommittees, and a panel of the National Academy of Sciences. J.M.S.

N80-27229# Committee on Science and Technology (U. S. House).
SOVIET SCIENTIFIC AND TECHNICAL COOPERATION WITH COUNTRIES OTHER THAN THE UNITED STATES
Robert Civiak Washington GPO 1979 112 p refs Rept. Presented to the Subcomm. on Sci., Res. and Technol., 96th Congr., 1st Sess., Feb. 1979 Prepared by Congressional Research Service, Library of Congress
(GPO-37-444) Avail: SOD HC

The countries other than the United States with which the Soviet Union has had significant contacts in science and technology are identified. Also information on the Soviet Union's most active areas of international cooperation in science and technology is provided. The Soviet Union's most extensive Western contacts are with France, Italy, West Germany, Finland and Japan. However, the members of the Council for Mutal Economic Assisstance (CEMA) are still the Soviet Union's prevailing partners in sceintific and technical cooperation. India, Vietnam, Iraq and Iran are the developing countries which have received the largest amounts of nonmilitary scientific and technical assisstance from the Soviet Union. The Soviet Union's most active fields of international scientific and technical activity are power engineering, petroleum and mining, metallurgy space and the chemicals industry. Western technology transfer to the Soviet Union is most extensive in the chemicals industry and also important in electronics and transportation. J.M.S.

N80-27230# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Electrical Power Lab.
EVA METRO SEDAN ELECTRIC-PROPULSION SYSTEM: TEST AND EVALUATION
E. Eberhart Reimers Sep. 1979 290 p refs
(Contract EC-77-A-31-1042)
(DOE/CS-1042/1) Avail: NTIS HC A13/MF A01

The procedure and results of the performance evaluation of the EVA Metro Sedan (car no.1) variable speed dc chopper motor drive and its three speed automatic transmission are presented. The propulsion systems for a battery powered vehicle manufactured by Electric Vehicle Associates, Valley View, Ohio, was removed from the vehicle, mounted on the programmable electric dynamometer test facility and evaluated with the aid of a HP 3052A Data Acquistion System. Performance data for the automatic transmission, the solid state dc motor speed controller, and the dc motor in the continuous and pulsating dc power mode, as derived on the dynamometer test facility, as well as the entire propulsion system are given. This concept and the system's components were evaluated in terms of commercial applicability, maintainability, and energy utility to establish a design base for the further development of this system or similar propulsion drives. DOE

N80-27231*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 7: HYBRID VEHICLE REVIEW
K. O. Leschly 30 Sep. 1979 44 p refs Sponsored by NASA 10 Vol.
(Contract EM-78-I-01-4209)
(NASA-CR-163298; CONS-4209-T1-Vol-7) Avail: NTIS HC A03/MF A01 CSCL 13F

Review of hybrid vehicles built during the past ten years or planned to be built in the near future is presented. An attempt is made to classify and analyze these vehicles to get an overall picture of their key characteristics. The review includes onroad hybrid passenger cars, trucks, vans, and buses. DOE

N80-27232# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY STORAGE SYSTEMS FOR AUTOMOBILE PROPULSION, 1979 STUDY. VOLUME 2: DETAILED REPORT
H. C. Forsberg, C. J. Anderson, E. Behrin, W. Cliff (Battelle Pacific Northwest Lab.), R. Crisp (Arkansas Univ.), C. L. Hudson (Interplan Corp.), L. G. OConnell, J. S. Payne, R. Renner, and M. D. Schrot 15 Dec. 1979 288 p refs
(Contract W-7405-eng-48)
(UCRL-52841-Vol-2) Avail: NTIS HC A13/MF A01

The findings of a national multilaboratory study of energy-storage propulsion systems for automobiles are presented, including a technical and cost update for the energy-storage devices and resultant vehicles. In addition, an evaluation methodology is described for national energy and market impact, a manufacturing and service infrastructure study is introduced, and an examination is made of certain specialty markets. The energy-storage device characteristics are projected and the resulting vehicles are evaluated. The systems analyzed included several that were not considered in the 1978 work, and three that had not been previously evaluated: the short-range but high-performance all-electric vehicle; the hydrogen-fuel-cell-powered electric; and the advanced-battery eV, power boosted with an advanced-design, fiber-composite flywheel. DOE

N80-27233# California Univ., Livermore. Lawrence Livermore Lab.
DYNAMIC TESTING OF THE ROADWAY POWERED ELECTRIC VEHICLE (RPEV) SYSTEM
D. D. Davis, C. W. Dease, Ronald I. Wallace, and Carl E. Walter 27 Feb. 1980 17 p refs Presented at the 3d Intern. Elec. Vehicle Exposition and Conf., St. Louis, 20-22 May 1980
(Contract W-7405-eng-48)
(UCRL-83662; CONF-800523-2) Avail: NTIS HC A02/MF A01

Practicality of the roadway powered electric vehicle (RPEV) system under dynamic operating conditions is being examined. In the RPEV system, energy is electromagnetically coupled without mechanical contact from a powered roadway to electric vehicles. Energy from the roadway can be used for high speed, long range travel, and for replenishing energy stored onboard the vehicles. The stored energy is available for shorter range travel on nonpowered surface streets. The dynamic test system includes a 50 m lane of powered roadway, an ac power source, and an electrically propelled test vehicle equipped with a roadway power pickup, onboard batteries, and instrumentation. The dynamic power coupling system allows up to 16 W of coupled power. Its design is based on results obtained from static prototype tests. Dynamic tests will examine power coupling capacity, system characteristics, vehicle performance, roadway compatibility, and safety. DOE

N80-27234# Ventura Regional County Sanitation District, Calif.
RESIDUAL WASTE MANAGEMENT: PHASE 1 REPORT Final Report, 1 Jan. 1975 - 15 Feb. 1978
Feb. 1980 145 p refs
(Contract EPA-S-803223-01-0)
(PB80-139744; EPA-600/2-80-051) Avail: NTIS HC A07/MF A01 CSCL 13B

The economic, social and environmental analysis regarding alternative plans for the handling and disposal of residual organic waste in Ventura County is presented. Waste quanities from municipal treatment plants, livestock operations, agricultural operations and meat and fish processes were inventoried. GRA

N80-27235# Vought Corp., Dallas, Tex.
AIRTRANS URBAN TECHNOLOGY PROGRAM. PHASE 2, VOLUME 5: SYSTEMS OPERATION Final Report
D. E. Benjamin, G. M. Jones, and G. F. Ruprecht Oct. 1979 133 p refs Sponsored by DOT
(PB80-157704; UMTA-TX-06-0020-79-6-Vol-5) Avail: NTIS HC A07/MF A01 CSCL 13F

The effects of several improvements on AIRTRANS operation were investigated. Among the improvements investigated and reported were increased speed, increased system capacity, additional bypasses and sidings, additional failure management strategies and demand mode operation. Much of this analysis was performed using ASIM, the AIRTRANS simulation model. Additional simulation work was performed using Vought's demand-responsive automated transit simulation model (DRATS) and the Transportation Systems Center's discrete event simulation model (DESM). GRA

N80-27236# Vought Corp., Dallas, Tex.
AIRTRANS URBAN TECHNOLOGY PROGRAM. PHASE 2, VOLUME 6: SEVERE WEATHER Final Report
W. C. Albach, R. A. Doores, R. J. Fewel, J. L. King, and B. L. Koonce Oct. 1979 170 p refs Sponsored by DOT
(PB80-157696; UMTA-TX-06-0020-79-7) Avail: NTIS HC A08/MF A01 CSCL 13F

Modifications to AIRTRANS, an automated guideway transit (AGT) system, that would allow the system to be used in urban locales with severe weather environments are identified. Results of analysis and testing of the vehicle and guideway components and systems which would be exposed to severe weather in urban AGT systems are reported. Also, cold and ice tests performed in the laboratory with components and subsystems installed on test fixtures are presented. Although significant progress has been made toward a severe weather capable AIRTRANS, more development is recommended. GRA

N80-27237# Florida Dept. of Administration, Tallahassee.
SCIENCE, ENGINEERING, TECHNOLOGY AND FLORIDA'S GOVERNMENT
Joseph H. Gerry and Malcolm P. Thomas Apr. 1979 99 p
(Grant NSF ISP-78-06131)
(PB80-139389; NSF/RA-790311) Avail: NTIS HC A05/MF A01 CSCL 05A

The structure and process of Florida's executive branch in relation to science, engineering, and technology (SET) was examined in order to determine a strategy to facilitate improvements in the way state resources are used in SET endeavors, and to provide assistance in the improvement of the policy formation process within Florida. Topics covered include an organizational profile of Florida's executive branch; a review of the overall relationship of the State Comprehensive Plan to SET; a synthesis of significant observation observations from respondents participating in interviews and survey questionnaires; an overview of the activities of other states including findings to be considered for Florida's improvement in SET; analysis of considerations affecting Florida's utilization of and relationship with SET; and development of strategic requirements and a proposal for an organizational structure for Florida. A project description and an overview of the development of SET in the United States are included in the appendix. GRA

N80-27238# Mitre Corp., McLean, Va.
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON ADVANCED PROPULSION SYSTEMS FOR URBAN RAIL VEHICLES
Feb. 1980 241 p Conf. held at Washington, D.C., 5-6 Feb., 1980
(PB80-149099; MTR79W00455; UMTA-VA-06-0053-80-1) Avail: NTIS HC A11/MF A01 CSCL 13F

It is shown that on the basis of current R&D activities in the area of propulsion system designs, advances in control systems, motor design, thermal control techniques, diagnostics and energy efficient systems are realizable. Both designer and user viewpoints toward the propulsion technology are presented. This approach has emphasized the experience of propulsion equipment in the transit environment and presented its effects on transit system performance. GRA

N80-27239# Massachusetts Inst. of Tech., Cambridge. Center for Transportation Studies.
POTENTIAL CHANGE STRATEGIES IN URBAN TRANSPORTATION: AN OVERVIEW AND TENTATIVE APPRAISAL Final Report, Jul. 1975 - Jan. 1978
Alan Altshuler, James Womack, and John Pucher Dec. 1979 87 p refs
(Contract DOT-OST-50240)
(PB80-155278; DOT/RSPA/DPB/50-79/8) Avail: NTIS HC A05/MF A01 CSCL 13B

Innovations in the urban transportation system which combine political feasibity and cost effectiveness are identified. Problems of urban transportation in the United States are emphasized. GRA

88 SPACE SCIENCES (GENERAL)

N80-27240# Astronomische Gesellschaft, Hamburg (West Germany).
REVIEW ARTICLES OF THE ASTRONOMISCHE GEBELLSCHAFT, NO. 47
1980 272 p refs In GERMAN and ENGLISH
(ISSN-0374-1958) Avail: NTIS HC A12/MF A01

The behavior of the intergalactic and interstellar media is studied with respect to insight into galactic evolution. Emphasis is placed on galactic radio sources, their properties and techniques of observation. For individual titles, see N80-27241 through N80-27250.

N80-27241# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
INTERGALACTIC MATTER AND THE EVOLUTION OF GALAXIES c90
George B. Field *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 7-55 refs (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

The current status of observations of gas within clusters and superclusters of galaxies, and perhaps outside of superclusters, is reviewed, with emphasis on the interpretation of X-ray emission by hot gas and the physical effects of such gas upon galaxies. It is concluded that while interfalactic gas probably makes a contribution to the mean desnity of the universe which is to for closure, it can nevertheless profoundly affect the evolution universe which is too small fro closure, it can nevertheless profoundly affect the evoluation of galaxies eitherby sweeping out their interstellar gas or by accreting on the to them. E.D.K.

N80-27242# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
XUV ASTRONOMY c89
K. P. Beuermann *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 65-88 refs In GERMAN; ENGLISH summary Prepared in cooperation with Technische Univ., Berlin, West Germany (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

The field of extreme ultraviolet astronomy at wavelengths from 50 A to 912 A is reviewed. Observations in this wavelength band can be performed due to the circumstance that the Sun is located in an extended region of extremeley low interstellar gas density. Hence, the horizon for observations at 100 A due to the photoelectric opacity of the interstellar medium is typically at a distance of about 200 pc. Sources which radiate primarily in the extreme ultraviolet were detected and even the small list of currently observed objects has had immediate impact on the studies of both stellar evolution and the interstellar medium. Diffuse emission from the interstellar medium results from a hot 100,000 to 1,000,000 K component of the interstellar gas. Prime stellar candidates for extreme ultraviolet observations are (1) hot low luminosity stars at the blue end of the HR diagram, (2) atmospheric emission from stars surrounded by a hot corona or with flaring acitivty, and (3) mass exchanging binary systems. The prospects of extreme ultraviolet astronomy are discussed and the existing observations of extreme ultraviolet emission from the interstellar medium and from stellar sources of the different categories are reviewed. E.D.K.

N80-27243# Wuerzburg Univ. (West Germany). Inst. fuer Astronomie und Astrophysik.
STELLAR CHROMOSPHERES c89
P. Ulmschneider *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 93-106 refs In GERMAN; ENGLISH Summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

Observations indicating the presence of stellar chromospheres are summarized. Undisputed indicators for hot stellar envelopes are spectral lines of highly ionized atoms, Fe (2) emission lines, flares in late type stars, and the presence of the He (1)

10830 A line. The combined evidence to date shows that all nondegenerate type stars have chromospheres except possibly the A stars. There are, however, theoretical reasons for expecting chromospheres in A stars. Empirical chromosphere models for a rapidly growing sample of stars was recently constructed on the basis of Ca (2) and Mg (2) line observations. A discussion of possible heating mechanisms is given and the relative importance of these mechanisms is evaluated. For the low and middle chromosphere the short period acoustics heating mechanisms seems to be the dominant process, although there are still uncertainties. Both steady and time dependent theoretical models of stellar chromospheres based on the short period acoustics heating theory are discussed, and predictions of these models are compared with results from empirical models. This relatively favorable comparison shows that the explanation of the Wilson-Bappu effect might be at hand. E.D.K.

N80-27244# Max-Planck-Institut fuer Radioastronomie, Bonn (West Germany).
RADIO CONTINUUM OBSERVATIONS OF NEARBY GALAXIES c93
R. Wielebinski *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 107-116 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

The radio continuum emission observed in galaxies is produced by both the thermal emission in ionized regions and the nonthermal emission from relativistic electrons spiralling in the magnetic fields of a galaxy. Recent observations at low frequencies and at high radio frequencies have similar angular and intensity resolution. In the disks of a number of nearby galaxies, spectral variations could be definitely identified. These in turn could be shown to be due to the mixing of thermal and nonthermal radiation. Using optical H alpha data, a lower limit to thermal emission from these H (2) regions can be predicted. In some galaxies there is evidence of emergence of the thermal emission as the major component at frequencies of 4800 MHz and above. Observations of the radio continuum emission away from the plane of the edge-on galaxies shows a dramatic steepening of the spectral index. This must be attributed to truncation of the electron energy spectrum and/or fall-off in the magnetic field intensity. Recent observations of M51, M31, and M33 indicate that in each of these galaxies large scale magnetic fields exist aligned along the spiral arm directions. E.D.K.

N80-27245# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE 80 cm X-RAY TELESCOPE: FACILITIES AND OBSERVATIONAL POSSIBILITIES c89
B. Aschenbach, H. Braeuninger, U. Briel, H. Fink, G. Kettenring, E. Pfeffermann, P. Predehl, and J. Truemper *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 117-137 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

A telescope with an 80 cm aperture was developed for emplementation on the space shuttle. The design features as well as its specifications for use are presented. R.C.T.

N80-27246# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
PLASMA DYNAMICAL PROCESSES IN THE SOLAR WIND c92
Arne K. Bichter *In* Astronomishche Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 139-164 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88) Avail: NTIS HC A12/MF A01

Observations of proton and electron velcity distributions and of their moments at different radial distances from the Sun and in different parts of streamstructured solar wind between 0.3 and 1 angstrom units are described. These observations are then compared with the corresponding results of theoretical studies on the plasmakinetics of a collisionless solar wind. The discrepancy deduced from these comparison then suggests that waves and their resonant interactions with these particles under consideration and instabilities of their distributions must play an important role in the physics of solar wind. In situ observations of these modes in the interplanetary medium are also discussed. Some of the theoretical results under which circumstances the proton and electron distribution might become unstable with respect to the ionacoustic mode are reviewed and some indirect observational evidence that these instabilities might indeed operate in the soalr wind are given. R.C.T.

N80-27247# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
ACCRETION OF PLASMA ONTO NEUTRON STARS c93
G. Boerner and H. Riffert *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 165-203 refs (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

Some aspects of the accretion of matter onto compact X-ray sources are discussed. The interaction of the accreted matter with the strong magnetic field of the compact star is considered. The hydrodynamics of the accretion flow is described. R.C.T.

N80-27248# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
PRESENT STATE AND FUTURE OF THE SCIENTIFIC SPACE PROGRAM OF THE FEDERAL REPUBLIC OF GERMANY c12
W. Regula *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 205-217 In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

Project management as well as implimentation proceedures of the European Space Agency are discussed. A number of aspects of science policy are also adressed. R.C.T.

N80-27249# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE IMPORTANCE OF THE LONG-TERM PLANNING OF THE EUROPEAN SPACE AGENCY FOR SPACE RESEARCH IN THE FEDERAL REPUBLIC OF GERMANY c81
K. Pinkau *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p. 219-232 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

The European space research and the European Space Agency are assessed for their technological contribution. Aspects of operations research as well as of financial management support are addressed. R.C.T.

N80-27250# Institut fuer Astrophysik und Extraterrestrische Forschung, Bonn (West Germany).
ASPECTS OF THE INTERACTION OF STARS WITH DENSE INTERSTELLAR GAS CLOUDS c90
Hans J. Fahr *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 233-276 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

Different hydrodynamical approaches to calculating the circumstellar gas flow are reviewed. The calculation of properties and dynamical variables of this flow is discussed for the case of a single particle kinetic or hydrodynamical approach. It is found that the physically appropriate approach to a specific problem is not always clear cut, rather, it is proved that a hydrodynamical treatment of the outer circumstellar regions sometimes has to be replaced by a single particle kinetic description of the inner regions since the local mean free paths become large compared to the dimensions of these regions. R.C.T.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-27251*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

DATA REDUCTION AND ANALYSIS OF SAS-1 DATA Final Report
Riccardo Giacconi Feb. 1979 30 p
(Contract NAS5-20048)
(NASA-CR-159990) Avail: NTIS HC A03/MF A01 CSCL 03A

An abstracted bibliography of 59 articles addressing the analysis of X-ray observations from the UHURU X-Ray Observatory (SAS-1) is presented. Investigations of galactic and extragalactic X-ray sources, X-ray binaries, and transient and burst phenomena are highlighted. M.G.

N80-27252# South African Astronomical Observatory, Sutherland.
SOUTH AFRICAN ASTRONOMICAL OBSERVATORY, 1978 Technical Report, period ending 1 Jan. 1979
8 Feb. 1979 32 p
Avail: NTIS HC A03/MF A01

Summaries of the research conducted during 1978 are presented. The research was in the area of globular clusters, variable stars, galactic structure, Magellanic clouds, X-ray sources, and Earth satellites. Publications during this period are listed, and the equipment, and facilities are described. F.O.S.

N80-27253# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
ASTRONOMIC POSITION ACCURACY CAPABILITY STUDY Final Report
Paul F. Gilbert and James K. Barton Oct. 1979 83 p refs
(AD-A080292; DMAHTC-TR-79-002) Avail: NTIS HC A05/MF A01 CSCL 03/1

Both first order (FO) and modified first order (MFO) astronomic position accuracy figures were determined in this study. Only qualified and experienced observers using refined techniques with Wild T-4 theodolites were evaluated. Only FK4 stars were observed. The Sterneck method of astronomic latitude observaton and reduction was employed. Astronomic longitude observations and reduction techniques used the meridian transit method.GRA

N80-27254# Royal Observatory, Edinburgh (Scotland).
THE UK 1.2m SCHMIDT TELESCOPE AND THE SOUTHERN SKY SURVEY. PART 3: PLATE COPYING
P. R. Standen and K. P. Tritton 1979 12 p refs
(ROE-OR-5; ISSN-0309-099X) Avail: NTIS HC A02/MF A01

The plate copying procedures used to make the atlas film copies of the blue (3aJ) half of a southern sky survey are described. The accepted original negatives for the survey are on 356 x 356 mm glass plates, 1 mm thick. The copying process has been optimized for the faintest objects. Intermediate positives are made using Kodak Process emulsion on 356 mm x 356 mm glass plates 3 mm thick. Copy plates are developed in Kodak D-76. Atlas film copies are produced from the positive using Kodak Aerographic 4421 emulsion on Estar Thick base. A Versamat 317 automatic processor is used for developing the films in Versamat B developer. All quality control procedures are given. Author (ESA)

N80-26362*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLANETARY RADAR
R. M. Taylor and G. S. Downs *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 150 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 03A

N80-27242# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
XUV ASTRONOMY
K. P. Beuermann *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 65-88 refs In GERMAN; ENGLISH summary Prepared in cooperation with Technische Univ., Berlin, West Germany (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

N80-27243# Wuerzburg Univ. (West Germany). Inst. fuer Astronomie und Astrophysik.
STELLAR CHROMOSPHERES
P. Ulmschneider *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 93-106 refs In GERMAN; ENGLISH Summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

N80-27245# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE 80 cm X-RAY TELESCOPE: FACILITIES AND OBSERVATIONAL POSSIBILITIES
B. Aschenbach, H. Braeuninger, U. Briel, H. Fink, G. Kettenring, E. Pfeffermann, P. Predehl, and J. Truemper *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 117-137 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-27241# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
INTERGALACTIC MATTER AND THE EVOLUTION OF GALAXIES
George B. Field *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 7-55 refs (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

N80-27250# Institut fuer Astrophysik und Extraterrestrische Forschung, Bonn (West Germany).
ASPECTS OF THE INTERACTION OF STARS WITH DENSE INTERSTELLAR GAS CLOUDS
Hans J. Fahr *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 233-276 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-27255*# Biospherics, Inc., Rockville, Md.
DEVELOPMENT OF BIOLOGICAL AND NONBIOLOGICAL EXPLANATIONS FOR THE VIKING LABEL RELEASE DATA Final Report, 15 Feb. 1979 - Feb. 1980
1 Jul. 1980 74 p refs
(Contract NASw-3249)
(NASA-CR-163291) Avail: NTIS HC A04/MF A01 CSCL 03B

The plausibility that hydrogen peroxide, widely distributed within the Mars surface material, was responsible for the evocative response obtained by the Viking Labeled Release (LR) experiment on Mars was investigated. Although a mixture of gamma Fe2O3 and silica sand stimulated the LR nutrient reaction with hydrogen peroxide and reduced the rate of hydrogen decomposition under various storage conditions, the Mars analog soil prepared by the Viking Inorganic Analysis Team to match the Mars analytical data does not cause such effects. Nor is adequate resistance to UV irradiation shown. On the basis of the results and consideration presented while the hydrogen peroxide theory remains the most, if not only, attractive chemical explanation of the LR data; it remains unconvincing on critical points. Until problems concerning the formation and stabilization of hydrogen peroxide on the surface

of Mars can be overcome, adhere to the scientific evidence requires serious consideration of the biological theory. A.R.H.

N80-27256*# Martin Marietta Corp., Denver, Colo.
STUDY OF SAMPLE DRILLING TECHNIQUES FOR MARS SAMPLE RETURN MISSIONS Final Report
D. C. Mitchell and P. T. Harris Apr. 1980 140 p
(Contract NAS9-15907)
(NASA-CR-160723; MCR-79-615-Issue-3) Avail: NTIS HC A07/MF A01 CSCL 03B

To demonstrate the feasibility of acquiring various surface samples for a Mars sample return mission the following tasks were performed: (1) design of a Mars rover-mounted drill system capable of acquiring crystalline rock cores; prediction of performance, mass, and power requirements for various size systems, and the generation of engineering drawings; (2) performance of simulated permafrost coring tests using a residual Apollo lunar surface drill, (3) design of a rock breaker system which can be used to produce small samples of rock chips from rocks which are too large to return to Earth, but too small to be cored with the Rover-mounted drill; (4)design of sample containers for the selected regolith cores, rock cores, and small particulate or rock samples; and (5) design of sample handling and transfer techniques which will be required through all phase of sample acquisition, processing, and stowage on-board the Earth return vehicle. A preliminary design of a light-weight Rover-mountsd sampling scoop was also developed. A.R.H.

N80-27257*# Santa Clara Univ., Calif. Dept. of Physics.
WIND TUNNEL SIMULATION OF MARTIAN SAND STORMS
Ronald Greeley 8 Jul. 1980 31 p refs
(Grant NsG-2286)
(NASA-CR-163262) Avail: NTIS HC A03/MF A01 CSCL 03B

The physics and geological relationships of particles driven by the wind under near Martian conditions were examined in the Martian Surface Wind Tunnel. Emphasis was placed on aeolian activity as a planetary process. Threshold speeds, rates of erosion, trajectories of windblown particles, and flow fields over various landforms were among the factors considered. Results of experiments on particles thresholds, rates of erosion, and the effects of electrostatics on particles in the aeolian environment are presented. J.M.S.

N80-27258*# Arizona State Univ., Tempe.
RESEARCH ON LUNAR MARE EMPLACEMENT AND IMPACT CRATERING EXPERIMENTS
Ronald Greeley, Peter H. Schultz, and Donald E. Gault 10 Jul. 1980 4 p refs
(Grant NsG-7429)
(NASA-CR-163264) Avail: NTIS HC A02/MF A01 CSCL 03B

A model was derived enabling the interpretation of lunar styles of volcanism through the analysis of various surface features. The model was applied to several areas on the Moon, including the Orientale Basin, the Smythii Basin, the Herigonious region, and several highland areas. Concurrent with the application of the model, several topical studies of various aspects of lunar volcanism were completed. A series of impact crater experiments was conducted at NASA Ames in order to determine the effect that viscous targets would have on cratering mechanics and morphology for application in studies of Martian ejecta flow craters. The results of the experiments led to a model that can account for the formation of multiple flow lobes and the general morphology of some aspects of Martian craters. A.R.H.

N80-27259*# Purdue Univ., Lafayette, Ind.
ON THE CHEMICAL COMPOSITION OF L-CHONDRITES
Charles W. Neal, Robert T. Dodd (State Univ. of New York, Stony Brook), Eugene Jarosewich (Smithsonian Inst., Washington, D.C.), and Michael E. Lipschutz Jul. 1980 36 p refs Submitted for publication
(Grant NGL-15-005-140)
(NASA-CR-163260) Avail: NTIS HC A03/MF A01 CSCL 03B

Radiochemical neutron activation analysis of Ag, As, Au, Bi, Co, Cs, Ga, In, Rb, Sb, Te, Tl, and Zn and major element data in 14 L4-6 and 3 LL5 chondrites indicates that the L group is unusually variable and may represent at least 2 subgroups differing in formation history. Chemical trends in the S/Fe rich subgroup support textural evidence indicating late loss of a shock formed Fe-Ni-S melt; the S/Fe poor subgroup seemingly reflects nebular fractionation only. Highly mobile In and Zn apparently reflect shock induced loss from L chondrites. However, contrasting chemical trends in several L chondrite sample sets indicate that these meteorites constitute a more irregular sampling of, or more heterogeneous parent material than do carbonaceous or enstatite chondrites. Data for 15 chondrites suggest higher formation temperatures and/or degrees of shock than for LL5 chondrites.
Author

N80-27260*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROJECT ORION: A DESIGN STUDY OF A SYSTEM FOR DETECTING EXTRASOLAR PLANETS
David C. Black, ed. 1980 214 p refs Original contains color illustrations
(NASA-SP-436; LC-80-11728) Avail: NTIS MF A01; SOD HC $5.50 CSCL 03B

A design concept for a ground based astrometric telescope that could significantly increase the potential accuracy of astrometric observations is considered. The state of current techniques and instrumentation is examined in the context of detecting extrasolar planets. Emphasis is placed on the direct detection of extrasolar planets at either visual or infrared wavelengths. The design concept of the imaging stellar interferometer (ISI), developed under Project Orion, is described. The Orion ISI employs the state-of-the-art technology and is theoretically capable of attaining 0.00010 arc sec/yr accuracy in relative astrometric observations. J.M.S.

N80-27261*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
MAGNETIC PUMPING OF PARTICLES IN THE OUTER JOVIAN MAGNETOSPHERE
J. E. Borovsky Mar. 1980 81 p refs Sponsored in part by NSF
(Grants NsG-7632; NGL-16-001-002)
(NASA-CR-163022; Rept-80-5) Avail: NTIS HC A05/MF A01 CSCL 03B

The mechanism of magnetic pumping consists of two processes, the adiabatic motion of charged particles in a time varying magnetic field and their pitch-angle diffusion. The result is a systematic increase in the energy of charged particles trapped in mirror (and particularly, magnetospheric) magnetic fields. A numerical model of the mechanism is constructed, compared with analytic theory where possible, and, through elementary exercises, is used to predict the consequences of the process for cases that are not tractable by analytical means. For energy dependent pitch angle diffusion rates, characteristic 'two temperature' distributions are produced. Application of the model to the outer Jovian magnetosphere shows that beyond 20 Jupiter radii in the outer magnetosphere, particles may be magnetically pumped to energies of the order of 1 - 2 MeV. Two temperature distribution functions with 'break points' at 1 - 4 KeV for electrons and 8 - 35 KeV for ions are predicted. A.R.H.

N80-27262# Battelle Pacific Northwest Labs., Richland, Wash.
DURABILITY OF METALS FROM ARCHAEOLOGICAL OBJECTS, METAL METEORITES, AND NATIVE METALS
A. B. Johnson, Jr. and B. Francis Jan. 1980 117 p refs
(Contract EY-76-C-06-1830)
(PNL-3198) Avail: NTIS HC A06/MF A01

Many objects fashioned from silver, copper, bronze, iron, lead, and tin have survived for several thousand years. Dry environments, such as tombs, appear to be optimum for metal preservation, but some metals have survived in shipwrecks for over a thousand years. Some meteoritic masses with ages estimated to be 5,000 to 20,000 years have weathered very little, while other masses from the same meteorites are in advanced stages of weathering. Copper masses from the Michigan deposits were transported by the Pleistocene glaciers. Areas on the copper surfaces which appear to represent glacial abrasion show minimal corrosion. Dry cooling tower technology demonstrates that in pollution free moist environments, metals fare better at tempera-

tures above then below the dewpoint. Thus, in moderate temperature regimes, elevated temperatures may be useful rather than detrimental for exposures of metal to air. In liquid environments, relatively complex radiolysis reactions can occur, particularly where multiple species are present. A dry environment largely obviates radiolysis effects. DOE

N80-26350*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING ORBITER COMPLETION MISSION AND VIKING LANDER MONITOR MISSION
R. L. Gillette *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 58-61 (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 03B

N80-26361*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DATA ACQUISITION FOR MEASURING THE WIND ON VENUS FROM PIONEER VENUS
J. R. Smith and R. Ramos (NASA. Ames Res. Center) *In its* The Telecommun. and Data Acquisition Rept. 15 Jun. 1980 p 140-149 refs (For primary document see N80-26341 17-12)
Avail: NTIS HC A09/MF A01 CSCL 03B

N80-27269*# Cornell Univ., New York.
GEOMORPHOLOGY OF MARTIAN VALLEYS
David Christopher *In* NASA, Washington Advan. in Planetary Geol. Jun. 1980 p 5-160 refs (For primary document see N80-27268 17-99)
Avail: NTIS HC A14/MF A01 CSCL 03B

N80-27271*# Washington Univ., St. Louis, Mo.
THE STRATIGRAPHIC SEQUENCE OF VOLCANIC AND SEDIMENTARY UNITS IN THE NORTH POLAR REGION OF MARS M.S. Thesis
Michael Edward Botts *In* NASA, Washington Advan. in Planetary Geol. Jun. 1980 p 267-326 refs (For primary document see N80-27268 17-99)
Avail: NTIS HC A14/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-27263*# National Aeronautics and Space Administration, Washington, D. C.
HOURLY AVERAGE VALUES OF SOLAR WING PARAMETERS (FLOW RATE AND ION TEMPERATURES) ACCORDING TO DATA OF MEASUREMENTS OF THE VENERA-9 AND VENERA-10 AUTOMATIC INTERPLANETARY STATIONS ON AN EARTH-VENUS DURING THE PERIOD JUNE 1975 - APRIL 1976
O. L. Vaysberg, A. V. Dyachkov, V. N. Smirnov, K. B. Tsyrkin, and R. A. Isaeva Jun. 1980 26 p Transl. into ENGLISH of Russian report Pr-494, Moscow, 1979 p 1-50 Transl. by Kanner (LEO) Associates, Redwood City, Calif. Original doc. prepared by Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-76213; Pr-494) Avail: NTIS HC A03/MF A01 CSCL 03B

Four electrostatic analyzers with channel electron multipliers as detectors were used to measure solar wind ionic flow. The axes of the fields of vision of two of these analyzers were directed along the axis of the automatic interplanetary station, oriented towards the Sun, while the other two were turned in one plane at angles of +15 deg and -15 deg. The full hemisphere of the angular diagram of each analyzer was approximately 5 deg. The energetic resolution was approximately 6%, and the geometric energy was 0.002 sq cm ave. keV. Each analyzer covered an energetic range of approximately 10 in eight energetic intervals. Spectral distributions were processed in order to obtain the velocity and temperature of the protons. Tabular data show the hour interval (universal time) and the average solar wind velocity in kilometers per second. A.R.H.

N80-27264*# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 424, PART 1 (PROMPT REPORTS). DATA FOR NOVEMBER 1979, OCTOBER 1979
Helen E. Coffey Dec. 1979 159 p
(PB80-156946; SGD-424-Pt-1; NOAA-80011701) Avail: NTIS HC A08/MF A01 CSCL 03B

This prompt report provides data on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, solar wind measurements, inferred interplanetary magnetic field polarities, mean solar magnetic field, and Boulder Geomagnetic Substorm Log. It also provides data on: daily solar activity center, sudden ionospheric disturbances, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N80-27265*# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 424, PART 2 (COMPREHENSIVE REPORTS). DATA FOR JUNE 1979 AND MISCELLANEA
Helen E. Coffey Dec. 1979 50 p
(PB80-156938; SGD-424-Pt-2; NOAA-80011702) Avail: NTIS HC A03/MF A01 CSCL 03B

This comprehensive report provides data on: solar radio emission, enegetic solar particles and plasma, and solar X-ray radiation. The miscellaneous data includes solar wind measurements, coronal holes, spacecraft observations, and solar flares. GRA

N80-27246# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
PLASMA DYNAMICAL PROCESSES IN THE SOLAR WIND
Arne K. Bichter *In* Astronomishche Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 139-164 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88) Avail: NTIS HC A12/MF A01

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-27266*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
PARTICLE ENERGIZATION IN THE INNER, NONAZIMUTHALLY SYMMETRIC MAGNETOSPHERES OF NEUTRON STARS
Joseph E. Borovsky, Christoph K. Goertz, and Glenn Joyce Mar. 1980 32 p refs Sponsored in part by NSF
(Grants NsG-7632; NGL-16-001-002)
(NASA-CR-163021; Rept-80-6) Avail: NTIS HC A03/MF A01 CSCL 03B

The energization process of magnetic pumping, a combination of time dependent magnetic mirror fields with pitch-angle scattering, is applied to trapped charged particles drifting in corotating, azimuthally nonsymmetric neutron star magnetospheres. When particle energization is balanced by synchrotron radiation loss, it is found that protons, rather than electrons, reach considerable kinetic energies and radiate, in the X-ray regime, at rates up to the 10 to the 6th power MeV/proton/sec. Author

N80-27267*# Stanford Univ., Calif. Inst. for Plasma Research.
CONTRIBUTION TO THE EXTRAGALACTIC X-RAY BACKGROUND FROM CLUSTERS OF GALAXIES
Marie-Christine S. Zolcinski and Arthur B. C. Walker, Jr. May 1980 22 p refs
(NASA-CR-163020 SUIPR-811) Avail: NTIS HC A02/MF A01 CSCL 03B

The contribution to the extragalactic background from clusters of galaxies in the 2-6 keV band was computed. Two different cluster luminosity functions and two different models for cluster evolution were considered and a cluster X-ray luminosity-temperature relationship of the type L alpha T sup alpha +1/2 was assumed. It is found that the overall contribution of clusters to the background is approximately 10% of the total observed X-ray extragalactic approximately 150 eV is superimposed on the observed background. This result is quite insensitive to the different set of assumptions made in the calculation.
A.R.H.

N80-27244# Max-Planck-Institut fuer Radioastronomie, Bonn (West Germany).
RADIO CONTINUUM OBSERVATIONS OF NEARBY GALAXIES
R. Wielebinski *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 107-116 refs In GERMAN; ENGLISH summary (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

N80-27247# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).
ACCRETION OF PLASMA ONTO NEUTRON STARS
G. Boerner and H. Riffert *In* Astronomische Ges. Rev. Articles of the Astronomische Ges., No. 47 1980 p 165-203 refs (For primary document see N80-27240 17-88)
Avail: NTIS HC A12/MF A01

99 GENERAL

N80-27268*# National Aeronautics and Space Administration, Washington, D. C.
ADVANCES IN PLANETARY GEOLOGY
Alex Woronow, ed. Jun. 1980 309 p refs
(NASA-TM-81979) Avail: NTIS HC A14/MF A01 CSCL 03B

Research reports concerning the planetary geology of Mars are presented. Topics covered include the geomorphology of Martian valleys and various aspects of Martian volcanology. For individual titles, see N80-27269 through N80-27271.

N80-27269*# Cornell Univ., New York.
GEOMORPHOLOGY OF MARTIAN VALLEYS c91
David Christopher *In* NASA, Washington Advan. in Planetary Geol. Jun. 1980 p 5-160 refs (For primary document see N80-27268 17-99)
Avail: NTIS HC A14/MF A01 CSCL 03B

Data on morphology and planetmetric characteristics of 240 Martian valley networks reveal seven network patterns (e.g., digitate, parallel, stem, centrifugal, centripetal (interior and exterior), and fragmented, and three major system assemblage categories (i.e., reoccurring juxtapositions of network patterns: integrated, longitudinal and slope valley systems). Integrated networks (e.g., combinations of parallel and digitate networks) are most like terrestrial dendritic networks, but well organized, space efficient, true dendritic patterns are markedly absent on Mars. A simple physical model was devised to correlate rate of decrease of slope down network with increasing tributary junction angles, in order to infer longitudinal profile from planimetric pattern. Dendritic terrestrial networks are consistent with this model with exponentially decreasing slopes. It is concluded that Martian valley systems are ancient landforms which show little evidence of having been formed by rainfall erosion. Truth table analysis of various alternative formation processes finds flow from lithospheric source accompanied by sapping as the most likely mechanism.
R.E.S.

N80-27270*# Arizona Univ., Tucson.
VOLCANO-ICE INTERACTIONS ON THE EARTH AND MARS Ph.D. Thesis c46
Carlton Carl Allen *In* NASA, Washington Advan. in Planetary Geol. Jun. 1980 p 165-264 refs (For primary document see N80-27268 17-99)
(Grant NGL-03-002-191)
Avail: NTIS HC A14/MF A01 CSCL 03B

Analogs to terrestrial table mountains, ridges and pseudocraters have been identified on Viking imagery of Mars, notably in Acidalia Planitia. Photointerpretation of this region has led to the formulation of a consistent geologic history. An ice rich regolith once overlay the present plains surface, and may still exist in the adjacent highlands. Volcanic eruptions beneath this layer produced the Martian analogs to table mountains and ridges. Estimates of the heights of these features indicate that the regolith averaged approximately 500 m thick. At some time, changes in in climate or subsurface heat flow led to melting of the ice and breakdown of the regolith. Subsequently the exposed lowlands were extensively resurfaced by thin lava flows. A similar history is postulated for all of the northern plains of Mars, based on the occurrence of geologic features resembling those in Acidalia Planitia. The ice rich regolith required by this model could have contained 8 times 10 to the 21st power cu cm of water. This is several times the total volume thought to have been outgassed by the planet, based on atmospheric measurements. A serious discrepancy thus exists between interpretations of geologic and atmospheric data concerning the history of water on Mars.
R.E.S.

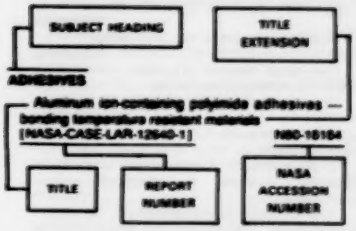
N80-27271*# Washington Univ., St. Louis, Mo.
THE STRATIGRAPHIC SEQUENCE OF VOLCANIC AND SEDIMENTARY UNITS IN THE NORTH POLAR REGION OF MARS M.S. Thesis c91
Michael Edward Botts *In* NASA, Washington Advan. in Planetary Geol. Jun. 1980 p 267-326 refs (For primary document see N80-27268 17-99)
Avail: NTIS HC A14/MF A01 CSCL 03B

Based on photogeologic mapping of Viking Orbiter images of Mars, four distinct informal stratigraphic units can be defined for the region north of 70 N latitude. They are: (1) bulbous plains, (2) mantled plains, (3) dune deposits, and (4) layered deposits/perennial ice. The bulbous plains unit underlies all other north polar units and represents a sub-unit of the mottled cratered plains. The low albedo of bulbous plains and the appearance of what appears to be a dike suggest that bulbous plains has a volcanic origin. Cumulative crater size frequency distribution functions for bulbous and mantled plains support the interpretation that mantled plains were formed by dust blanketing of bulbous plains. Dune deposits occur in the form of longitudinal, transverse, and barchan dunes, and possibly as sheet sand deposits. A gradation from densely spaced transverse dunes to more dispersed barchan and transverse dunes implies a general thinning of circumpolar dune deposits downwind of extensive areas mapped as bulbous plains. It is concluded that dune material is being stripped from bulbous plains and is accumulating as dunes downwind on mantled plains.
R.E.S.

N80-27272*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PUBLICATIONS OF THE JET PROPULSION LABORATORY, 1979 Bibliography Report, Jan. - Dec. 1979
15 May 1980 207 p
(Contract NAS7-100)
(NASA-CR-163287: JPL-Bibl-39-21) Avail: NTIS HC A10/MF A01 CSCL 05B

This bibliography includes 1004 technical reports, released during calendar year 1979, that resulted from scientific and engineering work performed, or managed, by the Jet Propulsion Laboratory. Three classes of publications are included: (1) JPL Publications; (2) articles published in the open literature; and (3) articles from the bimonthly Deep Space Network Progress Report. The publications are indexed by: (1) author, (2) subject, and (3) publication type and number. A descriptive entry appears under the name of each author of each publication; an abstract is included with the entry for the primary (first listed) author. Unless designated otherwise, all publications listed are unclassified.
J.M.S.

Typical Subject Index Listing



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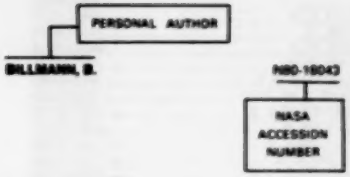

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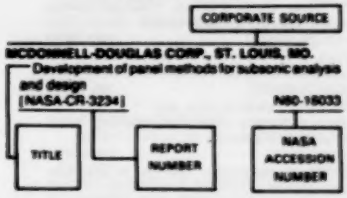

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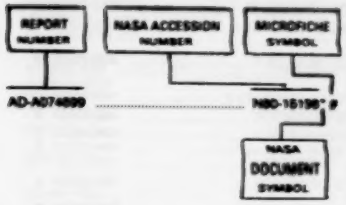

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